Exhibit B

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF NEW JERSEY

IN RE LG FRONT LOAD WASHING MACHINE CLASS ACTION LITIGATION	Case No. 2:08-cv-00051

EXPERT REPORT OF CHRISTOPHER KNITTEL, Ph.D.

April 23, 2015

Contents

I. INTRODUCTION

A. Qualifications

1. My name is Christopher Knittel. I am the William Barton Rogers Professor of Energy Economics in the Sloan School of Management at the Massachusetts Institute of Technology. I received a Ph.D. in economics from the University of California at Berkeley where my fields of specialization were industrial organization and econometrics in 1999. In 1996, I received a Masters of Arts in economics from the University of California at Davis. In 1994, I received a Bachelor of Arts, summa cum laude, in Economics and Political Science, from the California State University, Stanislaus.

2. Over the past ten years, I have presented my research at the Federal Trade Commission, the Department of Justice, Dartmouth, University of Arizona, University of Chicago, UC Irvine, UC San Diego, UC Berkeley, UCLA, UCSB, UC Santa Cruz, Iowa State University, University of Michigan, MIT, Harvard University, Northwestern University, Stanford University, Washington University, Yale University, the National Bureau of Economic Research summer and spring conferences, and the American Economic Association annual meetings.

3. I am a member of the American Economic Association. I am a Research Associate at the National Bureau of Economic Research in the Industrial Organization, Productivity, and Energy and Environmental Economics programs. I am the co-editor of the *Journal of Public Economics* and Associate Editor of two journals: The *Journal of Energy Markets* and the *Journal of Transportation Economics and Policy*. I was previously an Associate Editor for the *American Economic Journal: Economic Policy* and the *Journal of Industrial Economics*. I have also sat on the outside review committee for the National Science Foundation's Social and Economic Science grant program.

4. In addition, I have served as an ad hoc reviewer for: *American Economic Review, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics, Review of Economic Studies, American Journal of Economics: Applied Economics, Journal of Environmental and Economic Management, Energy Journal, Energy Economics, Journal of Industrial Economics, International Journal of Industrial Organization, Rand Journal of Economics, Operations Research, Canadian Journal of Economics, Contemporary Economic Policy, Economic Inquiry, Economic Journal, Economics and Politics, Journal of Banking and Finance, Journal of Economic Behavior and Organization, Journal of Law and Economics,*

Management Science, Review of Industrial Organization, Journal of Management Strategy, and other academic journals.

5. My research focuses on consumer and firm behavior and how consumers, firms, and policy makers interact in the marketplace; this is known as industrial organization. To estimate key parameters in these relationships, my research methods range from standard well-established methods, such as those used here, and, when necessary, cutting-edge econometric and statistical techniques. A number of my existing research papers relate to this case in terms of statistical techniques and the more general topic of how consumers and firms value particular product characteristics. I discuss these below.

6. I use a number of empirical techniques to form the basis of my opinion in this report. These are described in detail below, but can generally be described as demand estimation (to estimate consumers' willingness to pay to avoid machines where consumers experience increased problems related to mold). These techniques are widely used in the field; indeed, a number of my research papers use these specific techniques, and most use regression and econometric analysis more generally.[1] I have also taught the techniques used in my analysis at the Ph.D. and undergraduate levels.

---

[1] For instance, Knittel and Stango (2008) use a demand model similar to the demand model used in this report. We use this model to estimate how consumer welfare is affected by the introduction of surcharges once one considers both the negative effect of paying fees and the positive effect of an increase in ATM availability following the introduction in surcharges. Knittel, Christopher R. and Victor Stango, "Incompatibility, Product Attributes and Consumer Welfare: Evidence from ATMs," *The B.E. Journal of Economic Analysis & Policy*, Vol. 8, No. 1, January 2008, pp. 1935-1682.

Knittel and Metaxoglou (2008) as well as Knittel and Metaxoglou (2011) estimate the Bertrand-Nash equilibrium of markets using demand models similar to the ones used in my analysis here. Knittel, Christopher R. and Konstantinos Metaxoglou, "Estimation of Random-Coefficient Demand Models: Two Empiricists' Perspective," *The Review of Economics and Statistics*, Vol. 96, No. 1, March 2014, pp. 34-59 and Knittel, Christopher R. and Konstantinos Metaxoglou, "Challenges in Merger Simulation Analysis," *American Economic Review: Papers and Proceedings*, Vol. 101, No. 3, 2011, pp. 56-59.

Somewhat more broadly, a number of my papers deal with estimating the "demand" for goods. Hughes, Knittel, and Sperling (2008) estimate how the demand for gasoline is affected by gasoline prices and income and how this relationship has changed over the past 30 years. Hughes, Jonathan E., Chrisopher R. Knittel, and Daniel Sperling, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," *The Energy Journal*, Vol. 29, No. 1, 2008, pp. 113-134. Knittel and Sandler (2012) and Knittel and Sandler (2011) estimate the demand for miles travelled among consumers of different vehicle types. Knittel, Christopher R. and Ryan Sandler, "Carbon Prices and Automobile Greenhouse Gas Emissions: The Extensive and Intensive Margins," In *The Design and Implementation of U.S. Climate Policy*, University of Chicago Press, September 2012, pp. 287-299 and Knittel, Christopher R. and Ryan Sandler, "The Welfare Impact of Indirect Pigouvian Taxation: Evidence from Transportation," February 20, 2013, available at http://web.mit.edu/knittel/www/papers/cobenefits_latest.pdf, accessed on February 2, 2015. Kim and Knittel (2006) estimates the demand for electricity as a function of prices, weather, time of day and a variety of other factors as well as the ability of firms to charge prices above marginal costs in the wholesale electricity market. Kim, Dae-Wook and Christopher R. Knittel, "Biases in Static Oligopoly Models?:

7. My professional qualifications are described further in my curriculum vita, which is attached as Appendix A. A list of cases in which I have testified during the past four years is attached as Appendix B.

B. Assignment

8. I have been asked by counsel for the plaintiffs to determine the appropriate measure of damages owed to purchasers of LG front-loading washing machines ("front-loading washers") between 2003 and 2007.

9. In working on this report, I have been assisted by employees of Analysis Group, Inc., who worked under my direction. In this report, I use the terms "I" and "my" to refer to work performed by me and others under my supervision. The materials that I and others working under my supervision considered are listed in Appendix C.[2]

10. I am compensated at an hourly rate of $750 for my time in this matter. Analysis Group staff members assisting me in this engagement are being compensated at their standard hourly rates; I receive a portion of those fees in the form of attribution. This compensation is not contingent upon the nature of my findings or the outcome of this case, and I have no other financial interest in the outcome of this litigation.

11. Because my work on this matter is ongoing, I may review additional materials produced subsequent to the issuance of this report, and/or conduct further analysis. I reserve the right to update, refine, or revise my opinions, or to form additional opinions accordingly.

II. SUMMARY OF FINDINGS

12. Using data from a choice-based conjoint survey with a test-and-control structure conducted by Sarah Butler in January 2015, I estimate damages to proposed class members using basic economic principles and methodologies. Using a nested logit approach to analyze consumers' choices, I measure the average loss in utility that

---

Evidence from the California Electricity Market," *The Journal of Industrial Economics*, Vol. 54, No. 4, December 2006, pp.451-470. Knittel and Metaxoglou (2008) estimate the demand for electricity as a function in addition to the ability of firms to price above marginal costs in ancillary service electricity markets. Knittel, Christopher R. and Konstantinos Metaxoglou, "Diagnosing Unilateral Market Power in Electricity Reserves Market," *Journal of Energy Markets*, Vol. 1, No. 1, March 25, 2008, pp. 65-95.

[2] The materials considered include materials from other litigation involving front-loading washing machines (e.g., the reports authored by Professor Murphy, Mr. Wecker, and Professor Rysman in the Bosch litigation; the reports authored by Professor Bresnahan, Dr. Van Audenrode, and Dr. Gans in the Whirlpool litigation; and the reports authored by Professor Bresnahan, Dr. Marais, and myself in the Sears litigation).

results from purchasing a LG front-loading washing machine with a mold issue when that mold issue was not known by the consumer prior to purchase. I describe these as "willingness-to-pay" damages, because it is a measure that compares consumers' willingness to pay for a LG front-loading washing machine with no known mold issue to one that is known to have a mold issue. Willingness-to-pay damages are $279 per machine.

13. I also estimate damages to proposed class members by examining how LG at-issue washing machines would have been priced had consumers known of the mold issue. That is, I compare the price of LG front-loading washing machines to the price of LG front-loading washing machines that would have been required from consumers, in order to sell the same number of machines, had consumers known about the mold issue. These "market price overcharge" damages are the same amount as "willingness-to-pay" damages ($279) in my baseline specification. (When using a model that allows market price overcharge damages to differ from willingness-to-pay damages, market price overcharge damages can be higher.)

14. Additionally, I have estimated damages to proposed class members by measuring the cost to consumers of mitigating the mold with a specialty product that manufacturers such as LG have recommended to consumers to help avoid or minimize mold and odor issues. I describe these damages as "mitigation cost" damages, which I estimate to be $235 per machine.

III. BACKGROUND

15. It is my understanding that retail washing machines are generally categorized under two main design types: top-loading washers and front-loading washers. In a top-loading washer, laundry is loaded via a top-mounted door, while in a front-loading washer, laundry is loaded into the horizontally-mounted drum via a hinged door on the front of the machine.

16. According to EuroMonitor, front-loading washer retail volume sales, as a percent of all washing machine retail volume sales, grew from two percent in 2000, to approximately 20 percent in 2006, to over 30 percent in 2013.[3] On the other hand, according to The NPD Group, Inc., which produces data that washing machine manufacturers such as Whirlpool use, front-loading washing retail volume sales rose to as high as 40 percent in 2011 but then declined to 30 percent in the first quarter of

[3] "Passport: Consumer Appliances 2014," *Euromonitor International*, extracted May 10, 2014.

2012 (the last quarter for which Whirlpool produced NPD data).[4] From 2007 to 2013, the top five brands—Kenmore, Whirlpool, Maytag, GE, and LG—accounted for over 85 percent of all washing machine unit sales.[5]

17. I understand that the plaintiffs allege that certain LG-branded front-loading washers from 2003 through 2007 (the "Class Period"):

> have inherent design defects that cause them to (a) accumulate mold, mildew or similar residue within the Washing Machines; (b) produce foul and noxious odor that escapes from the Washing Machines; (c) produce mold, mildew and/or foul odor on clothes washed in the Machines; and (d) be unusable for the ordinary purpose which the Washing Machines were sold.[6]

18. I understand that Ms. Butler conducted a survey of current and past owners of front-loading washers and found that over 25 percent of LG, Kenmore, and Whirlpool front-loading washers (and over 35 percent of LG front-loading washers) had mold or odor problems.[7]

IV. APPROACHES TO ASSESSING DAMAGES

19. For purposes of my report, I assume that a jury or judge finds that plaintiffs' core engineering claim in this case—that LG front-loading washers accumulate mold

---

4 NPD Data, W0539589, produced by Whirlpool for use in the LG matter.

5 "Passport: Consumer Appliances 2014," *Euromonitor International*, extracted May 10, 2014.

6 Consolidated Amended Complaint, *In re: LG Front Load Washing Machine Class Action Litigation*, In the United States District Court for the District of New Jersey, Case No. 2:08-cv-00051-FSH-MAS, May 6, 2008. ("Complaint"), ¶ 2.

7 I note that repair and complaint rates cannot be used to assess the extent of harm, particularly since neither mold nor odor issues were covered under warranty. Also, LG could not fix the mold issues when consumers complained, but could only mitigate them for a time. Furthermore, researchers who study post-purchase behavior have found that consumers likely overstate satisfaction once a purchase is made. (See, for example, Brehm,, Jack W., "Postdecision Changes in the Desirability of Alternatives," *The Journal of Abnormal and Social Psychology*, Vol. 52, No. 3, May 1956, pp. 384-389.) Even when consumers are dissatisfied, researchers have found that there is often a gap between consumer dissatisfaction and complaint to the retailer or manufacturer. (See, for example, Singh, Jagdip and Robert E. Wilkes, "When Consumers Complain: A Path Analysis of the Key Antecedents of Consumer Complaint Response Estimates," *Journal of the Academy of Marketing Science*, Vol. 24, No. 4, Fall 1996, pp. 350-365.) Consumers may choose not to complain for reasons such as bad prior experiences with the complaint process (e.g., poor customer service), low expectation of resolution (e.g., issue not covered by warranty), and attribution of blame to themselves (e.g., consumers not aware of the design defect may think that the mold or odor issue is due to their insufficient care of the machines). There are also multiple avenues for consumers to act on their dissatisfaction other than complaining to the retailer or manufacturer, such as talking to friends and relatives and writing to consumer protection agencies.

and/or odor at a higher rate than traditional top-loading washers—is true. More specifically, to reach the damages issues that I address in this report, a jury must find for the plaintiffs on relevant liability issues, so I assume this finding—that the at-issue LG front-loading washers were not "fit for the ordinary purpose for which" washing machines are used.[8] I am not an expert on such matters, and I offer no opinion on that underlying claim.

20. Damages to consumers who purchased the at-issue LG front-loading washers can be assessed using three approaches. I describe these below.

A. Willingness to Pay

21. A consumer's economic valuation for a good (or a particular feature of a good) can be assessed using the willingness-to-pay (WTP) measure, which is the *most* that a consumer would be willing to pay for that product (or, in this case, for a particular feature of that product). At that price, the consumer is exactly indifferent between having the good (or the feature) and not having it.

22. For example, suppose that a consumer's willingness to buy a new car featuring an 8-cylinder engine, relative to a car with a 6-cylinder engine, is $2,500. If the manufacturer charges only $2,000 more for the car with 8-cylinder engine, then such a consumer will choose the model with an 8-cylinder engine, because she values that feature at $2,500 but needs to pay only $2,000 more for that car than she would for the car with the 6-cylinder engine. If, however, the manufacturer charges $3,000 more for the 8-cylinder engine car, then that particular consumer will *not* buy the model with the 8-cylinder engine, because the price for that feature exceeds the value to the consumer. And if the manufacturer charges exactly $2,500 more for the car with the 8-cylinder engine, then the consumer will realize the same value if she purchases the 6-cylinder model or the 8-cylinder model; she would get $2,500 more in value for the latter but she would pay, incrementally, that same amount to get it.

23. One approach to assessing damages compares consumers' valuation of the at-issue front-loading washers when consumers are specifically given knowledge that the machines have issues with mold or odor with the amount that consumers will pay when they are not specifically given this knowledge. That is, we can compare consumers' WTP for an at-issue front-loading washer in a market in which they are

[8] I have been retained in cases involving two other brands of front-loading washers which face similar liability claims—Whirlpool and Kenmore. Unless indicated otherwise, I assume, for the purposes of calculating damages, that LG alone is found liable. I make that assumption because I understand that the judges and juries in the case against LG cannot make liability findings against Whirlpool and Kenmore.

generally unaware of the mold issue to consumers' WTP for an at-issue front-loading washer in a market in which they are told about the mold issue. Because LG customers generally were not aware of the mold issue prior to purchase, the difference between these two WTP numbers constitutes a reasonable estimate of the economic loss to consumers.

24. The estimation of WTP only requires direct measurement of the demand side of the market, not the supply side. Consumer demand, and hence WTP, can be reliably estimated based on well-established methodologies using transaction or survey data, as described further below. From an economist's perspective, the willingness-to-pay approach is the soundest for estimating the economic damages to consumers. This approach is a direct measure of the change in the economic value the consumer believed she was receiving at the time of purchase, compared to the economic value from the at-issue washing machine that she actually received. As such, the change in her willingness to pay measures the damages she incurred from purchasing a washing machine that did not perform as expected. Introducing the supply side of the market can be useful if, for example, we were interested in measuring the seller's *benefit* from selling a defective washer, e.g., the incremental profits or sales the seller achieved as a result. However, because the appropriate measure of harm in this case is the consumer's loss from the at-issue washer design, introducing the supply side is unnecessary (and could misstate consumer harm).[9]

25. I understand that one of the alternative approaches to measuring damages discussed below may be found more legally relevant. For this reason, I present calculations based on an evaluation of market-price overcharges and mitigation costs, in addition to the calculated damages from the WTP approach.

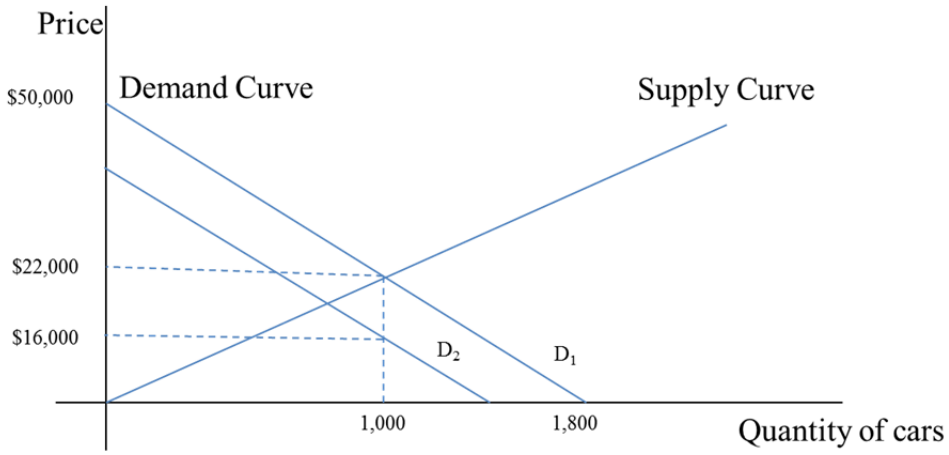
B. Market Price Overcharge

26. A second measure of damages compensates all consumers for overpaying for the at-issue front-loading washers. This measure is determined by comparing the average price of the at-issue washers in the marketplace to the price that LG would have needed to charge consumers in a but-for world where the mold issues were known to consumers in order for LG to achieve comparable unit sales. In particular, if LG were

[9] As I discuss below, introducing the supply side of the market and solving for a new equilibrium in the but-for world can yield a result where, for example, many fewer units are sold in the but-for world, but the price is largely unchanged. The implication would be, incorrectly, that consumers have not been harmed. But in fact, many consumers would have been harmed – their lack of knowledge about a mold issue may have induced them to purchase a washer that they otherwise would not have purchased if the mold issue had been known.

to sell machines with mold issues to the same number of consumers as in the actual world, the price that LG could have charged would have needed to be lower in the face of reduced demand for those machines resulting from the knowledge of the mold and odor problem. I refer to this approach as the "market price overcharge."

27. To understand the economics of this approach, consider the graphical depiction of supply and demand below. Assume that D_1 represents demand for automobiles with 8-cylinder engines. Where D_1 intersects the supply curve determines the price and quantity sold in the market. Here, the market equilibrium price is $22,000 and 1,000 units are sold (say, per month).



If demand for 8-cylinder engine cars shifts from D_1 to D_2, we observe that by lowering its price to $16,000, the manufacturer could continue to sell 1,000 cars each month.

28. The purpose of the market price overcharge approach is to quantify the differences in price for at-issue front-loading washers in an actual world where demand is not impacted by the mold issues (because the mold issues are not widely known) and the price in a but-for world where demand is impacted by those issues (because they are widely known), holding constant the number of front-loading washers sold. As an example, if we know that LG sold 500,000 front-loading washers at an average price of $1,000 in the actual world, the relevant question to ask is: what market price would LG have needed to charge in order to sell those same 500,000 front-loading washers

in a but-for world, had consumers known about the mold issues? The market price overcharge corresponds to this change in price.[10]

C. Cost of Mitigation

29. Another sensible approach to quantifying the damage caused to LG front-loading washer purchasers is to consider the amount of money those consumers would have to spend to turn their machine into the machine that they reasonably expected to receive from LG. These costs can be thought of as *mitigation damages* or the lowest cost of working around the alleged mold or odor issues.

30. During the proposed class period, Whirlpool introduced a product called Affresh.[11] Affresh is a tablet that consumers use in connection with the clean cycle of their washing machines. Whirlpool claimed that Affresh, when used regularly, can prevent a number of the negative features associated with front-loading washers, such as buildup of mold, mildew, and biofilm.[12] Similarly, Tide introduced a specialty cleaning product, "Tide Washing Machine Cleaner," in 2009.[13] LG recommends the use of a specialty cleaning product such as Affresh or Tide Washing Machine Cleaner in its use and care manuals.[14] LG refers to these products as "tub cleaner" or "cleaning tablets" in its use and care manuals, and I will adopt the term "tub cleaner" for the purpose of my report.[15]

31. Any manufacturer that recommends the use of tub cleaner, is, in essence, communicating to consumers that the cost to them from leaving the mold problem unmitigated is larger than the lifetime cost of the tub cleaner. Put differently, the cost

---

10 Dr. Van Audenrode and Professor Rysman, in their respective reports in Whirlpool and Bosch, estimated damages in a conceptually similar manner. In Appendix E, I describe their approaches and explain the differences between their approaches and mine.

11 Whirlpool began marketing Affresh to consumers in 2007. "Whirlpool to Sell Cleaner for High-Efficiency Washers," *Reuters*, September 26, 2007, available at http://www.reuters.com/article/2007/09/26/whirlpool-cleaner-idUSN2618448820070926, accessed on January 28, 2015; and "How Whirlpool Puts New Ideas through the Wringer," *BloombergBusinessWeek*, August 3, 2009, available at http://www.businessweek.com/innovate/content/aug2009/id2009083_452757.htm, accessed on January 26, 2015.

12 *See* footnote 18 to my report in the Sears matter.

13 "Tide® Washing Machine Cleaner Helps Eliminate Washing Machine Malodor," *Tide Newsroom*, December 18, 2009, available at http://news.tide.com/press-release/tide-washing-machine-cleaner-helps-eliminate-washing-machine-malodor, accessed on April 8, 2015.

14 *See* LGUSA_FLW0033034 – LGUSA0033040. *See also* P & G 0070 – P & G 0082; *See also* LG Owner's Manual, Washing Machine – WM2240C, p. 25.

15 *See* LG Owner's Manual, Washing Machine – WM2240C, p. 25; *See also* LG Owner's Manual, Washing Machine – WM2650H*A, p. 29.

of a lifetime supply of the tub cleaner should be less than LG's assessment of the cost to the user of having a washing machine with a mold or odor problem (otherwise, consumers would have no incentive to purchase the tub cleaner).[16]

32. To see this, suppose the damages from a product with mold or odor issues are X. Suppose also that the lifetime cost of the tub cleaner is Y. If the consumer is made aware of mold or odor issues, she will choose to use tub cleaner only if X is greater than Y. In other words, she will choose to use tub cleaner only if the cost of using tub cleaner is lower than the cost of ignoring mold issues (which would occur even if she was not aware of those issues in the first place). The same logic applies to firms that recommend tub cleaner. A firm that recommends tub cleaner to its customers necessarily believes that the costs of the tub cleaner over the life of the washing machine are below the costs its consumers would face if they were to leave the mold unmitigated.

V. ESTIMATION OF CONSUMER DEMAND

33. In order to estimate willingness-to-pay damages and market-price-overcharge damages, we must first estimate consumer demand for front-loading washers. Furthermore, in order to measure demand in the actual and but-for worlds, we must understand how consumers would value an at-issue front-loading washer if they are told about a mold problem and how consumers would value an at-issue front-loading washer if they are not told about such a problem. That is, we must estimate how changes in the information set impacts demand associated with a particular attribute of the washing machine. I do so using data generated by Ms. Butler's conjoint study, to which I apply standard methodologies in economics. I describe those methodologies here.

A. Valuing a product attribute

34. In order to understand how consumers value specific attributes of a product, economists often apply standard statistical techniques to actual transaction data or simulated market data. For example, if appropriate transaction-level data were available, one could evaluate how consumer choices changed during the proposed class period once the nature of the mold issue with front-load washing machines was

[16] This approach necessarily assumes that consumers in a but-for world would have been made aware of mold issues once the purchase was made and would have used the tub cleaner as a way to mitigate the damages from those issues. As such, one must assume that the product would have been available and would have been clearly discussed with consumers in context, with full information regarding the mold problems with the at-issue machines.

revealed. Alternatively, when those data are not available, one can survey consumers and determine how their choices and preferences change when such information is or is not available. Whether using transaction-level data or simulated market data, researchers observe choices that consumers made between different products, and measure reactions to various attributes of the products from which the consumer was choosing, including price. By observing a sufficiently high number of consumers and choices, researchers can infer, with a high degree of statistical certainty, the dollar value that consumers place on each attribute. These methods fit under the broad description of "discrete choice analysis."

35. Suppose, for example, that consumers could choose between only two automobiles in the marketplace. The two models were identical in all respects, except that one featured a 6-cyclinder engine while the other featured an 8-cylinder engine, and the price of the car with the 8-cylinder engine was $2,000 more than the price of the car with the 6-cyinder engine. Suppose that we observed that *no* consumers purchased the car with the 8-cylinder engine; we could then conclude that consumers ascribe *less than* $2,000 of value to a larger engine. Likewise, if we observed that *all* consumers purchased the car with the 8-cylinder engine, we could then conclude that consumers ascribed *at least* $2,000 of value to the added horsepower provided by an 8-cylinder engine relative to a 6-cylinder engine. More realistically, we would expect that some consumers will choose the less expensive, less powerful car and some consumers will choose the more expensive, more powerful car. By observing how many choose one and how many choose the other, we can mathematically calculate a dollar value that consumers *on average* assign to the larger engine.[17]

36. One type of data that researchers use to conduct discrete choice analysis is conjoint data, i.e., data generated from prospective consumers in a simulated market environment, choosing a product from a set of potential choices. Each product has a different set of attributes and a price, and, as they would in the marketplace, the prospective consumers indicate which product they would choose to purchase. By observing those choices and the price differences of various products, we are able to estimate consumers' average valuations for each attribute.[18] In conjoint analysis, the

---

[17] In this highly simplified example, we can identify the upper and lower bounds of a population's willingness to pay. An illustration of the process by which *average* willingness to pay can be estimated requires more technical detail; see Appendix F.

[18] Where reliable market or transaction level data are available, these are often used as well. For instance, studies of demand for groceries often rely on scanner-level sales data, because these data are readily available. I am not aware of reliable market data for front-loading washers; NPD gathers some market level data but does not include any Kenmore sales because it does not collect data from Sears. Moreover, even data like NPD's would be insufficient for my purposes because we would be unable to observe the effect of

choice sets are designed based on the question one intends to answer. For example, the choice sets can be presented under different descriptions of the front-loading feature (with or without mold issues), so that some consumers have different information than other consumers. Similarly, the choice sets can offer the front-loading feature independently from the high-efficiency feature, so that the value of individual features can be estimated separately. (In the real world, where two product features are often offered jointly, market data may not be useful in estimating the value of each separately.)

B. Prevalence of conjoint studies in academia and business

37. The use of conjoint data to understand consumer preferences, feature and product valuations, and demand characteristics is commonplace – both in the academic literature and in industry. Green, Krieger, and Wind (2001), for example, document numerous uses of conjoint analysis in real-world settings.[19] Orme (2014) devotes an entire chapter in his book on conjoint analysis to applications in industry, describing its use at major corporations such as Proctor & Gamble, General Motors, and Microsoft.[20] Among the various types of conjoint analysis, Sawtooth Software, a developer of popular software used by marketing academics and practitioners, states that choice-based conjoint (the type of conjoint study that Ms. Butler designed) is the most widely used.[21] Of note, conjoint analysis has been used specifically in the context of washing machines: Sammer and Wüstenhagen (2005) use a choice-based conjoint to estimate the value that consumers place on the EU Energy eco-label (similar to the Energy Star certification in the U.S.).[22] Other academic papers use conjoint survey data to estimate demand in numerous other contexts, such as Allenby,

---

differences in the knowledge set between consumers, to the extent that there were *any* consumers during the proposed class period that had knowledge of the full extent of the mold issues that influence consumer's valuations of these machines (and I am not aware of any timeframe when consumers *were* generally aware of the extent of mold issues). As described further, Ms. Butler's conjoint study allows us to overcome this lack of pertinent market data.

19 Green, Paul E., Abba M. Krieger, and Yoram (Jerry) Wind, "Thirty Years of Conjoint Analysis: Reflections and Prospects," *Interfaces*, Vol. 31, No. 3, 2001, pp. S56-S73.

20 Orme, Bryan K. *Getting Started with Conjoint Analysis*, Third Edition, Research Publishers, Glendale, CA, 2014.

21 Sawtooth Software, Inc., "The CBC System for Choice-Based Conjoint Analysis (Version 8)," *Sawtooth Software Technical Paper Series*, available at https://sawtoothsoftware.com/download/techpap/cbctech.pdf, accessed on January 20, 2015.

22 Sammer, Katharina and Rolf Wüstenhagen, "The Influence of Eco-Labelling on Consumer Behaviour–Results of a Discrete Choice Analysis for Washing Machines," *Business Strategy and the Environment*, Vol. 15, No. 3, 2005, pp. 185-199.

Arora, and Ginter (1995) who observe that conjoint analysis is "one of the most widely use research techniques in marketing."[23]

C. Description of Ms. Butler's Conjoint Survey

38. Between January 13 and January 20, 2015, Ms. Butler conducted a conjoint survey of 2,205 respondents over the age of 18 who indicated that they were currently considering purchasing a new washing machine within the next 12 months and would be actively involved in the purchase decision. Ms. Butler's conjoint survey used a study design in which respondents were randomly assigned to a treatment group or a control group which varied with respect to their exposure to information regarding the nature of the mold or odor present in the at-issue machines.[24]

39. Before respondents started the discrete choice exercise in which they selected machines they would be most likely to purchase, they were exposed to a stimulus—a Washing Machine Buying Guide that provided information to consumers that they should consider when making their purchase decision. The language presented in the Washing Machine Buying Guides shown to respondents in the treatment and control groups was identical, except for one additional passage presented to the treatment group that provides information regarding the accumulation of mold in certain front-loading washers.

40. Due to the test-and-control design of Ms. Butler's conjoint study, the data it produced can be used to determine how consumers' preferences and willingness to pay for the at-issue washing machines are affected by information relating to mold or odor. The design also reduces the effect of any exogenous factors that may confound or bias the results. In essence, the survey design mimics the randomized control trial methods that are generally regarded as the "gold standard" for isolating the effect of one particular treatment, input, or intervention, such as the techniques used in testing the efficacy of pharmaceuticals. By randomly assigning consumers to either the treatment or the control group, a researcher can eliminate bias that may be present in non-experimental settings. In the case of a pharmaceutical trial, that difference is the use

---

[23] *See*, e.g., Allenby, Greg M., Neeraj Arora, and James L. Ginter, "Incorporating Prior Knowledge into the Analysis of Conjoint Studies," *Journal of Marketing Research*, Vol. 32, No. 2, 1995, pp. 152-162; Jedidi, Kamel and Z. John Zhang, "Augmenting Conjoint Analysis to Estimate Consumer Reservation Price," *Management Science*, Vol. 48, No. 10, 2002, pp. 1350-1368; and Luo, Lan, P. K. Kannan, and Brian T. Ratchford, "New Product Development Under Channel Acceptance," *Marketing Science*, Vol. 26, No. 2, 2007, pp. 149-163.

[24] I understand that prior to this study, Ms. Butler conducted a survey to determine the extent to which owners of front-loading washers experienced mold issues, relative to owners of top-loading washers.

of the drug. In this setting, that difference is the information regarding the accumulation of mold and associated odor in certain front-loading washing machines.

41. As in the automotive example above, by observing choices made by prospective consumers, we are able to estimate the value that consumers place on each feature of the washing machine. Thus, for example, we can estimate the value that consumers place on the front-loading feature of a washing machine (relative to the alternative, top-loading feature), separate and apart from the value they may place on other features that are often (though not exclusively) offered with the front-loading rather than the top-loading machines, such as high-efficiency.

42. Importantly, we can also estimate the value that consumers place on the front-loading feature of a washing machine in the but-for world where issues relating to mold or odor are understood by consumers. That is, we can specify a machine (or a set of machines) whose feature sets are exactly the same as those in the actual world, but where consumers' knowledge set with respect to an attribute (or attributes) is different, and hence, the value that consumers place on those same attributes can differ.

43. The data produced through Ms. Butler's conjoint survey are therefore well-suited for estimating the harm to consumers attributable to issues relating to mold or odor and the extent of damages owed to purchasers of LG front-loading washing machines should a judge or jury find LG liable for those issues.

D. Demand Analysis

i. Using estimates of demand to measure damages

44. The respondents in the control group of Ms. Butler's conjoint survey represent the actual world; hence, when they read about front-loading washers, they do not read about the mold issue before making their choices because, as I discussed above, my assumption of liability is that a jury or judge determines that the machines are "not fit for their ordinary purpose"[25] and that consumers were generally unaware of this fact. By analyzing the choices made by these respondents in Ms. Butler's conjoint survey, we can estimate the value that they place on the at-issue washing machines (absent

[25] I understand that the language of liability in other cases, such as Whirlpool and Sears, may be phrased differently. I note that differences in language do not alter the economic basis of damages relating to washing machines with mold issues assuming a jury finds liability as a result of those issues. Therefore, my approach to damages would be the same in Whirlpool and Sears.

knowledge of the mold issue).[26] The resulting value reflects the value that consumers *expected* to (but did not) receive when purchasing their front-loading LG washers.

45. The respondents in the treatment group of Ms. Butler's conjoint survey reflect consumers' preferences in the but-for world; that is, they are meant to reflect consumers' preferences in a world in which consumers would have been aware of the mold issues. To mimic this but-for world, respondents in the test group read about washing machines generally and about the mold issue before making their choices. By analyzing their choices, we can estimate the value that they place on the "front loader" feature (as distinct from the "top loader" feature) in a world where consumers are aware of the mold issues. This estimate represents the (lower) *actual* value to consumers of the at-issue washing machines, in light of the assumed liability finding that the at-issue machines are in fact "unfit for their ordinary purpose."

46. We expect that, all else being equal, the value to a consumer of a front-loading machine will be lower if the consumer is aware that the machine has a mold issue than if he is not. Thus, by comparing the valuation of the front-loading feature of the group that was aware of the mold issues to the valuation of the group that was unaware of them, I can estimate the loss in economic value experienced by proposed class members as a result of purchasing a machine. I note that the best measure of damages for any member of the proposed class is the population-wide average measure. It is only the population-level parameters that can be reliably assessed and utilized. Individual-level measures are unreliable because there are not enough data points for any individual to generate a measure with sufficient statistical power.

47. In order to estimate consumers' valuation of the at-issue washing machines, with and without awareness of the mold issue, we must estimate consumers' demand and the parameters of that demand (i.e., the impact of each attribute on demand for the product). In the next section, I discuss the estimation of those parameters.

ii. Estimating the parameters of demand

48. In economics, the demand for a product, or a product's "demand curve," is the relationship between the value the consumer places on the product and the prices and characteristics of that product. I estimate the demand for each washing machine, and then calculate the reduction in consumers' willingness to pay for front-loading

[26] Respondents in the control group who indicated that they were aware of a mold and odor issue in front-loading washing machines are excluded from the control group to provide a clean estimate of consumer preferences when the knowledge of the mold issue is absent. As discussed below, I have conducted sensitivity analyses that also include these respondents.

washers, as well as the reduction in LG prices in order for the same number of LG machines to have been sold if consumers had known about the mold or odor issues in the front-loading washing machines, Appendix D discusses the technical details of the analysis. In short, I follow a well-established literature in economics to estimate the demand curves in the actual and but-for worlds. Once I have estimated the parameters of demand in both the actual and but-for worlds, I can measure both the change in willingness to pay and the change in price.

49. In the economics literature, this type of analysis has been used to answer a variety of questions. For example: the estimation of how prices deviate from costs (see, for example, Berry, Levinsohn, and Pakes (1995)[27] and Goldberg (1995)[28]), the introduction of new products (Petrin (2002)[29]), the effect of voluntary export restraints on prices and market shares (Goldberg (1995)[30]), and the effect of environmental regulations on the automobile industry (Jacobsen (2013) [31]).

50. The basic structure of this demand analysis is also consistent with recent analyses used in merger cases.[32] In these cases, economists have estimated the demand for

---

27 Berry, Steven, James Levinsohn, and Ariel Pakes, "Automobile Prices in Market Equilibrium," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 841-890.

28 Goldberg, Pinelopi Koujianou, "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 891-951.

29 Petrin, Amil, "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, Vol. 110, No. 4, August 2002, pp. 705-729.

30 Goldberg, Pinelopi Koujianou, "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 891-951.

31 Jacobsen, Mark R., "Evaluating U.S. Fuel Economy Standards in a Model with Producer and Household Heterogeneity," *American Economic Journal: Economic Policy*, Vol. 5, No. 2, May 2013, pp. 148-187.

32 For applications and discussions of similar demand models applied to simulating the effect of a merger for antitrust policy, see Werden, Gregory J. and Luke M. Froeb, "The Effects of Mergers in Differentiated Product Industries: Logit Demand and Merger Policy," *Journal of Law, Economics, and Organization*, Vol. 10, No. 2, October 1994, pp. 407-426; Werden, Gregory J., Luke M. Froeb, and Timothy J. Tardiff, "The Use of the Logit Model in Applied Industrial Organization," *International Journal of the Economics of Business*, Vol. 3, No. 1, 1996, pp. 83-105; Epstein, Roy J. and Daniel L. Rubinfeld, "Merger Simulation: A Simplified Approach with New Applications," *Antitrust Law Journal*, Vol. 69, 2001, pp. 883-919; Werden, Gregory J. and Luke M. Froeb, "Calibrated Economic Models Add Focus, Accuracy, and Persuasiveness to Merger Analysis," In *The Pros and Cons of Merger Control*, edited by the Swedish Competition Authority, Swedish Competition Authority, Stockholm, 2002, pp. 63-82; Ivaldi, Marc and Frank Verboven, "Quantifying the effects from horizontal mergers in European competition policy," *International Journal of Industrial Organization*, Vol. 23, No. 9-10, December 2005, pages 669-691; Werden, Gregory J. and Luke M. Froeb, "Unilateral Competitive Effects of Horizontal Mergers," In *Handbook of Antitrust Economics*, MIT Press, September 2006; Davis, Peter and Eliana Garces, "The Determinants of Market Outcomes," In *Quantitative Techniques for Competition and Antitrust Analysis*, Princeton University Press, 2009; and Budzinski, Oliver and Isabel Ruhmer, "Merger Simulation in Competition Policy: A Survey," *Journal of Competition Law & Economics*, Vol. 6, No. 2, September 11, 2009, pp. 277-319.

products in the market where a proposed merger takes place, then simulate what prices, quantities, and profitability would be after the merger.[33] In this matter, in contrast to merger analysis, which is concerned with both consumer and producer surplus, we are concerned only with the impact on consumer welfare from the sale of washing machines with mold issues. Therefore, I focus my estimation upon the shift in the demand curve, and measure the difference in price that would have been required for purchasers of LG front-loading washers to have been indifferent between buying a machine with mold issues (at a lower price) or a machine without mold issues (at a higher price).

51. The basic structure of this class of econometric model relates a consumer's "utility" — i.e., the economic value that she gets from a given product—to the characteristics of the product, one of which will be price, and consumer-specific factors. For example, the utility that a consumer gets from a given car depends on a host of product characteristics, such as the car's price, horsepower, fuel economy, manufacturer, etc. Consumers choose the car that gives them the most utility (economic value). Different consumers will also choose different cars on their idiosyncratic preferences.

52. I apply what many refer to as a "conditional logit" demand model, as well as a "nested logit" demand model, to analyze the survey data provided by Ms. Butler. The

---

33 While the specific analysis used by the DOJ and the FTC in any given merger is often confidential, it is known that the DOJ and FTC have relied on these models in their analysis of competition issues. Werden, for example, was an economist at the DOJ when he wrote Werden, Gregory J. and Luke M. Froeb, "The Effects of Mergers in Differentiated Product Industries: Logit Demand and Merger Policy," *Journal of Law, Economics, and Organization*, Vol. 10, No. 2, October 1994, pp. 407-426 and Werden, Gregory J., Luke M. Froeb, and Timothy J. Tardiff, "The Use of the Logit Model in Applied Industrial Organization," *International Journal of the Economics of Business*, Vol. 3, No. 1, 1996, pp. 83-105. Likewise, Daniel Hosken was an economist at the FTC when he wrote Weinberg, Matthew C. and Daniel Hosken, "Using Mergers to Test a Model of Oligopoly," October 15, 2008, available at http://www.ftc.gov/sites/default/files/documents/public_events/first-annual-microeconomics-conference/mweinberg.pdf, accessed on January 27, 2015. Likewise, Nathan Miller was an economist at the DOJ when he wrote Miller, Nathan and Matthew Osborne, "Competition Among Spatially Differentiated Firms: An Empirical Model with an Application to Cement," Economic Analysis Group Discussion Paper, March 2010, available at http://www.justice.gov/atr/public/eag/257581.pdf, accessed on January 27, 2015 (presentation available at http://www.ftc.gov/sites/default/files/documents/public_events/3rd-annual-microeconomics-conference/miller_slide.pdf, accessed on January 27, 2015). Likewise, Charles Taragin and Michael Sandfort were both at the DOJ when they authored Taragin, Charles and Michael Sandfort, "The Antitrust Package," May 29, 2014, available at http://cran.r-project.org/web/packages/antitrust/vignettes/manual.pdf, accessed on January 27, 2015.

See also Vita, Mike, "Merger Simulation at the FTC," presentation available at http://www.ftc.gov/sites/default/files/documents/public_events/first-annual-microeconomics-conference/vita.pdf, accessed on January 27, 2015.

two models have a similar setup, in that the utility a consumer receives from a product is the sum of the mean utility from each product feature, plus a deviation from the mean that captures individual- and product-specific factors such as consumer taste and unobserved product characteristics. The two models differ in their assumptions regarding the correlation among deviations from the mean utility. While both demand models assume that deviations from the mean are uncorrelated across consumers, they make different assumptions regarding the correlation of deviations from the mean across different products offered to the same consumer. In the conditional logit model, the deviations from the mean utility are assumed to be uncorrelated across products. In the nested logit model, the products are divided into "nests" or groups, such as top-loading machines and front-loading machines. In this model, consumers' purchasing decision is modeled as a two-step process: they first pick a product type that they most prefer (i.e., front-loading or top-loader washer) and then choose a product within the preferred group. The deviations from mean for the same consumer are assumed to be correlated across products within the same group, through a common "shock" in the utility function that is experienced on all products within the group. Since changes in mean utility, rather than individual deviations from the mean, are the focus of class-wide damages assessment, either of these models can be used to assess damages in this matter.[34] Both models are commonly used in the economics literature.

53. Given that there are unobserved tastes and other idiosyncrasies (such as random mistakes in decision making), these demand models do not provide predictions on any one consumer's choices. Rather, these models provide estimates of the probability that an average consumer would choose each of the products in a choice set.[35] These probability estimates also correspond to estimates of average "take rates" among all consumers, which, as explained below, form the basis of my "market price overcharge" damages calculations.

---

[34] As discussed above, these population-level parameters, rather than individual-level parameters, can be reliably estimated with sufficient statistical power.

[35] The *actual* machine chosen by each consumer may not coincide with the machine that provides highest *estimated mean* utility for at least two reasons. First, these types of inconsistencies can be explained by idiosyncratic component of the demand model which is observed by consumers, but not observed by the researcher. Second, the estimated parameters reflect population-level averages, instead of individual-level values. As explained above, there are not enough data points for any individual to generate reliable individual-level estimates.

VI. ESTIMATION OF DAMAGES

A. Willingness-to-Pay Damages

54. As noted, I considered both a conditional logit and a nested logit structure. For the purposes of an analysis that is meant to capture average willingness to pay across consumers, I do not believe that heterogeneity across consumers would meaningfully affect the estimation (a claim made by Professor Timothy Bresnahan in related litigation); nevertheless, to account for the possibility that purchasers of front-loading washers may differ from purchasers of top-loading washers in ways that could affect the estimation, I present the results using a nested logit structure as my baseline specification. In particular, I assume that consumers first choose whether to purchase a front-loading washer or a top-loading washer (or no washer at all), and then decide which model to purchase.

55. The parameter of interest for the estimation of damages in this case is the coefficient on the "front loader" attribute—this parameter measures the utility gained by consumers from a machine being a front-loading washer, as opposed to a top-loading washer. We expect that respondents in the treatment group, who read the buying guide and learned that certain brands of front-loading washers had a mold issue, will value the "front loader" attribute less than those in the control group, who did not read about a mold issue.

56. I estimate the parameters based on all choices made by respondents in both the test group and the treatment group. I also include a "front-loader" treatment dummy variable—that is, a variable that takes the value of 1 if the respondent was in the treatment group and selected a front-loading washer, and a value of 0 otherwise; this interaction term, in effect, allows me to measure the degree, if any, to which the treatment group values the "front loader" variable differently from the control group. As Exhibit 1 shows, our expectations are borne out: the interaction term is negative and significant, indicating that respondents in the treatment group do value the "front loader" feature less than respondents in the control group. The coefficient estimates for the study on which I rely in this report are consistent with economic theory, and clearly show that consumers in a but-for world would have been willing to pay considerably less for the at-issue washing machines. In addition, as I show in Exhibit 2, the parameters of the model closely predict the actual choices of Ms. Butler's respondents.

57. To estimate the willingness to pay associated with this treatment effect, I divide the "front loader" parameter with the estimated parameter for price. This yields a willingness-to-pay measure of $279. That is, consumers value front-loading washers $279 less when they are aware of issues relating to mold than when they are not.

Accordingly, if we make the assumption that consumers who purchased these machines generally would not have been aware of problems relating to mold, their average loss of economic value is $279.[36] [37] [38] [39] [40]

---

[36] Exhibit G1 of Appendix G presents results using a conditional logit specification.

[37] In my baseline specification, the price effect is assumed to be linear. Exhibit G2 of Appendix G presents results where the price effect is allowed to be non-linear. Willingness-to-pay damages are higher at most price points than my baseline result.

I understand that in the Bosch case, Professor Murphy and Mr. Wecker both cited an article in the *British Journal of Management* (BJM) which found, for certain types of products, that choice-based analyses using market data yielded different results than choice-based analyses using conjoint data. The authors described the differences as the result of hypothetical bias, attributing the bias to the fact that in a conjoint study, respondents do not have out-of-pocket expenses. *See* Sichtmann, Christina, Robert Wilken, and Adamantios Diamantopoulos, "Estimating Willingness-to-pay with Choice-based Conjoint Analysis – Can Consumer Characteristics Explain Variations in Accuracy?" *British Journal of Management*, Vol. 22, 2011, pp. 628-645.

Professor Murphy and Mr. Wecker incorrectly extrapolated this finding to all conjoint analyses, and argued that the conjoint analysis used in the Bosch case could not be relied upon because of the "hypothetical bias." I believe that their conclusions are both incorrect and inapplicable. First, the types of products described in the BJM article were things like Chinese food and chocolate. I do not believe this is a reasonable basis for concluding that choice-based conjoint analysis will always yield inflated willingness-to-pay measures, especially for a durable good like a washing machine. On the contrary, Green, Krieger, and Wind (2001) point out that conjoint analyses were used in designing the EZ-Pass system. The overall forecast, based on these studies, was a take rate of 49 percent – remarkably close to the 44 percent take rate observed seven years later. *See* Green, Paul E., Abba M. Krieger, and Yoram (Jerry) Wind, "Thirty Years of Conjoint Analysis: Reflections and Prospects," *Interfaces*, Vol. 31, No. 3, 2001, pp. S56-S73. More broadly, it is difficult to imagine that conjoint analyses would be used as prevalently as they are if these biases were indeed as endemic as Professor Murphy and Mr. Wecker assumed they were.

[38] Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded from the analysis. Respondents in the control group who were previously aware of mold issues with front-loading washing machines are also excluded from the primary analysis, but are considered separately by Ms. Butler. Exhibits G3-A and G3-B present sensitivity analyses that include these respondents.

[39] In Exhibit G4-A of Appendix G, rather than estimate the parameters on the full dataset, I first estimate parameters using just the control group. I then estimate the "front loader" coefficient for the treatment group, constraining all other parameters to be equal to those estimated in the control group. In Exhibit G4-B of Appendix G, I allow all parameters to vary between the control and treatment groups.

[40] This analysis assumes that no consumers in the proposed class were aware of mold issues. I understand that Ms. Butler found that among respondents in the control group (after quality-control-related exclusions), 25 percent were aware of a mold issue relating to front-loading washers in 2014. I consider that a conservative upper bound on the degree of knowledge among proposed class members during the proposed class period, for several reasons. First, I assume that information tends to accumulate in the market over time; therefore, if 25 percent of consumers today are aware of the mold issue, it is likely that significantly fewer had such awareness during the proposed class period beginning in 2001. In fact, Ms. Butler found in her mold study that most owners of front-loading washers during this period were first-time owners of front-loading washers, and consequently would have had no prior experience with front-loading washers (or with the mold issue). Further, even those who reported recently in Ms. Butler's study that they were aware of a mold

B. Market Price Overcharge Damages

58. As discussed above, market price overcharge damages measure the difference in price that LG would charge all proposed class members between the actual and but-for worlds.

59. To conduct this analysis, I apply the parameter estimates from the nested logit analysis to real-world product attributes and product prices. In particular, my price overcharge analysis focuses on consumers' choices among the five major brands of washing machines that are presented to consumers in Ms. Butler's conjoint survey – LG, General Electric, Kenmore, Maytag, and Whirlpool.[41] I collected price and product attributes for all models of washers sold by these brands in 2006 and 2007, as reported by Consumer Reports.[42] By applying the results of the logit analysis to the prices and attributes of these real-world machines, I can estimate a "take rate" of LG front-loading washing machines in the actual world, assuming that consumers are not aware of mold issues in LG front-loading washers (or any other brand of front-loading washers). Then, by fixing that rate and holding constant the prices of all other machines, I can calculate the average price that LG would need to charge in a but-for world where consumers are aware of the mold issues in LG front-loading washers.

---

issue may not be fully aware of its extent and ramifications. Exhibit G5-A of Appendix G presents results when I model different levels of awareness in my estimation. For instance, in the scenario where 5 percent of consumers are assumed to be aware of mold issues in the actual world, 95 percent of consumers experience a $279 loss of economic value, while 5 percent experience no loss (hence, a weighted average of $265). Exhibit G5-B presents results wherein the awareness adjustment is made at the estimation stage by including the control group respondents who expressed awareness of a mold issue in the analysis.

41 These are the top-selling brands in the marketplace. *See* "Passport: Home Laundry Appliances in the US," *Euromonitor*, May 2014.

42 I employ a choice set consisting of washing machines that were in the marketplace during the proposed class period, specifically in the 2006-2007 timeframe. In my baseline specification, the results will not be sensitive to the choice set; that is, whether a choice set reflecting current choices in the marketplace (consistent with the timeframe of the conjoint survey) or whether the choice set reflects options in the marketplace after the proposed class period, the result will be the same in my baseline specification. For instance, I have conducted my analysis using a choice set of washing machines that were in the marketplace in the 2013-2014 timeframe (i.e., the timeframe closest to when Ms. Butler's conjoint survey was conducted); the results of my baseline specification do not change.

Consumer Reports describes its methodology: "How do you pick the models you test? We try to test models that represent the spectrum of products in a given market. Our analysts seek out products with new features and technological advances and a wide range of prices. After they analyze market share, marketing strategy, and advertising and promotional materials, they contact manufacturers to determine whether items will be available for at least three months after a report is published. The analysts then recommend a list of models that managers in our technical and editorial divisions review." "How we test: Appliances & Home products," *Consumer Reports*, available at http://www.consumerreports.org/cro/about-us/whats-behind-the-ratings/testing/appliances-home/index.htm, accessed on January 28, 2015.

60. Using the demand parameters from my nested logit analysis, combined with the choice set data based on the models covered by Consumer Reports, price overcharge damages are $279, i.e., the same as the change in willingness to pay. This equivalence is a function of my baseline specification of the nested logit; in my baseline specification of the nested logit framework, knowledge of the mold issue only affects consumers' valuation of the front-loading feature, and consumers have uniform preferences on mold treatment and price sensitivity; so, by changing price by the difference in willingness to pay, LG is able to restore all consumers to their original level of utility (I note that changing the baseline specification in this case so that the knowledge of the mold issues affects product attributes other than the front-loading feature leads to *higher* market price overcharge damages in the sensitivity analysis presented in Exhibit G4-B of Appendix G). To do so, it must lower its price by that average decline in willingness to pay, and must charge every consumer $279 less than it did in the actual world.[43] [44] [45] [46] [47]

---

[43] This analysis assumes that no consumers were aware of mold issues with respect to any brand of front-loading washer. This analysis also assumes that in the but-for world, consumers are aware of mold issues in LG front-loading washers but not in other brands' front-loading washers. In my baseline specification of the nested logit framework, the results will not be sensitive to the assumptions made about other firms in the but-for world; that is, whether one assumes that only LG front-loading washers have a known mold issue, or whether other brands alleged to have a mold issue, namely Whirlpool and Kenmore, are assumed to have a known mold issue, the result will be the same in my baseline specification of the nested logit framework (assuming, in the latter scenario, that Whirlpool and Kenmore, like LG, seek to maintain share in the but-for world).

[44] Exhibit G1 of Appendix G presents results using a conditional logit specification.

[45] Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded from the analysis. Respondents in the control group who were previously aware of mold issues with front-loading washing machines are also excluded. Exhibits G3-A and G3-B of Appendix G present sensitivity analyses that include these respondents.

[46] In Exhibit G4-A of Appendix G, rather than estimate the parameters on the full dataset, I first estimate parameters using just the control group. I then estimate the "front-loader" coefficient for the treatment group, constraining all other parameters to be equal to those estimated in the control group.

In Exhibit G4-B of Appendix G, I allow all parameters to vary between the control and treatment groups. Here, because all parameters vary between the test group and the control group, the model measures both a direct effect of information about mold on consumers' preferences for the "front loader" feature, as well as indirect effects on consumers' preferences for other attributes of washing machines, including price and brands. Because this model includes direct and indirect effects, care must be taken to apply these appropriately – an approach that applies both the direct and the indirect effect to not-at-issue front-loading washers would misstate damages. To model the but-for world where liability is found only for LG front-loading washers, in which mold issues were known for LG front-loading washers but not for other brands, the direct effect is relevant only with respect to preferences for LG front-loading washers, but the indirect effects, which can be thought of as spillovers, apply to both LG front-loading washers and all others washers as well.

C. Mitigation Cost Damages

61. As discussed above, mitigation cost damages represent the baseline cost to the consumer of avoiding mold issues. Also as discussed above, LG recommends the use of a specialty "tub cleaner" product such as Affresh or Tide Washing Machine Cleaner in its use and care manuals.

62. The mitigation damages associated with this type of tub cleaner product would be the discounted lifetime cost of Affresh or Tide Washing Machine Cleaner. In order to calculate this number, I make the following assumptions:
    - The life of a washing machine is 10 years;[48]
    - The cost of tub cleaner is $2.33 per tablet;[49]
    - An appropriate discount rate is 3.25 percent.[50]

63. Applying the inputs described above, this yields an annual cost of $27.96 and a lifetime cost of $279.60. As I show in Exhibit 3, I discount this cost to account for the present value at the time of purchase of the washing machines, which is $235 using a discount rate of 3.25 percent. This number takes into account only the direct cost of the tub cleaner to the consumer.

---

47 Exhibit G5-A of Appendix G presents results when I model different levels of awareness in my estimation. Exhibit G5-B presents results wherein the awareness adjustment is made at the estimation stage by including the control group respondents who expressed awareness of a mold issue in the analysis.

48 This is an assumption that Dr. Bresnahan used in his own analyses in his first Whirlpool report (*see* Bresnahan Whirlpool Report, p. 32) and that I used in my report in the Sears matter. It appears to be consistent with assumptions made by LG in the regular course of business. *See* LGUSA_FLW0032031–LGUSA_FLW0032037 at LGUSA_FLW0032036 ("Since major appliances generally last for about 10 years, consumers may be reluctant to purchase a bold color, such as red or blue or green, if they are concerned they might become disenchanted with the color after a few years.").

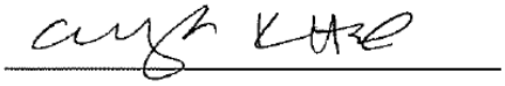
49 Google Shopping lists the lowest price for a three tablet packet of Affresh as $6.99. "Affresh Washer Cleaner, HE - 3 tablets, 4.2 oz," 2015, available at https://www.google.com/shopping/product/17138942502923477 87?q=affresh%20washer%20cleaner&rlz=1C1CHFX_enUS503US503&espv=2&biw=1280&bih=631&sqi=2&bav=on.2,or.r_cp.r_qf.&bvm=bv.83829542,d.eXY&ion=1&tch=1&ech=1&psi=qR-8VKL4O4S-ggTB14CYCA.1421615019065.3&prds=paur:ClkAsKraXx8nlQDBtsdh0AJwgEubh6LRG86vZbVa-klTU449vUJSfPBoCQ0bg4B7TK48l-U70G3WRBHjMb5PG2RXWvaXRsMKkFEeXgJ73eNfgkMTcSaiQIH4DhIZAFPVH73tjSVJ6spJkZunFYKRgeqXuc9kGA,scoring:p&ei=sR-8VN-kFcKlgwSNs4O4Aw&ved=0CGkQpiswAA, accessed on January 18, 2015. Tide lists the MSRP for Tide Washing Machine Cleaner as $6.99, *see* "Tide® Washing Machine Cleaner Helps Eliminate Washing Machine Malodor," *Tide Newsroom*, December 18, 2009, http://news.tide.com/press-release/tide-washing-machine-cleaner-helps-eliminate-washing-machine-malodor, accessed on April 8, 2015.

50 Professor Gans used a 3.25 percent discount rate, as did Professor Rysman, reflecting the Prime Rate. *See* Gans Whirlpool Report, pp. 21-24; *see also* Expert Report of Marc Rysman, February 14, 2014, pp. 15-16.

64. When calculating mitigation damages, an economist also could and might well consider the time that a consumer is told to spend each month running a cleaning cycle and the cost of water and energy associated with that cycle. Because my mitigation damages finding of $235 per class member does not account for those or any other costs, it is a conservative number.

VII. CONCLUSIONS

65. Using methods that are generally accepted in economics, I find that damages to each class member is $279 per machine under the WTP and market price overcharge methods and $235 per machine under the cost mitigation approach. I have reached my conclusions with a reasonable degree of scientific certainty, consistent with the standards of the field of economics.



Christopher Knittel

Exhibit 1
Nested Logit Demand Parameters and Damages Estimates

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.037		(0.028)
Maytag	-0.002		(0.028)
Whirlpool	0.102	***	(0.027)
LG	0.070	**	(0.027)
Front Load	0.042		(0.029)
Medium	0.424	***	(0.028)
Large	0.926	***	(0.030)
Extra Large	1.048	***	(0.030)
High Efficiency	1.165	***	(0.025)
Price	-1.773	***	(0.037)
Front Load * Treatment	-0.495	***	(0.035)
Constant	0.444	***	(0.042)
λ_{Top}	0.771	***	(0.022)
λ_{Front}	0.748	***	(0.022)
N	85,800		

Damages Measures

Average Value Loss (WTP)	$279.00
Market Price Overcharge	$279.00

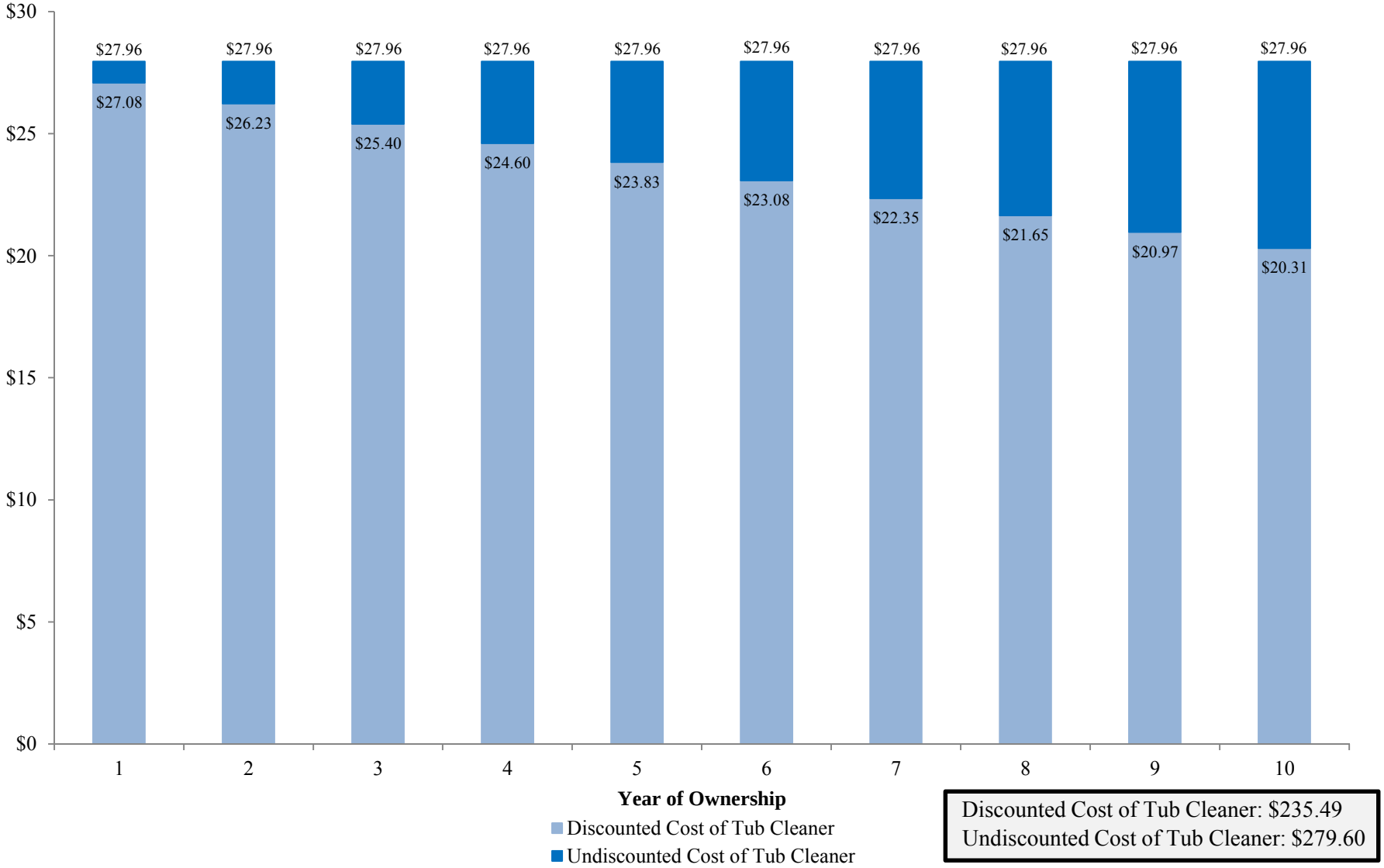
Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Treatment*Front_Load" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit 2
Comparison of Actual and Predicted Take Rates by Product Attribute

	Control Group		Treatment Group		All Respondents	
Attribute	**Actual**	**Predicted**	**Actual**	**Predicted**	**Actual**	**Predicted**
No Purchase	16.38%	16.13%	19.19%	19.39%	17.98%	17.98%
By Design						
Top	41.17%	41.42%	47.86%	47.67%	44.97%	44.97%
Front	42.45%	42.45%	32.94%	32.94%	37.06%	37.06%
By Brand						
GE	15.67%	16.25%	16.26%	15.77%	16.00%	15.98%
Kenmore	16.36%	16.18%	15.10%	15.22%	15.65%	15.64%
Maytag	16.11%	16.61%	16.28%	15.95%	16.21%	16.24%
Whirlpool	17.61%	17.58%	16.81%	16.90%	17.16%	17.19%
LG	17.86%	17.26%	16.36%	16.77%	17.01%	16.98%
By Size						
Small	28.43%	27.79%	30.25%	30.82%	29.46%	29.51%
Medium	16.94%	17.21%	16.68%	16.44%	16.79%	16.78%
Large	26.04%	26.35%	25.55%	25.33%	25.76%	25.77%
Extra Large	28.59%	28.64%	27.52%	27.41%	27.98%	27.94%
By Efficiency						
Not HE	36.71%	36.85%	39.57%	39.44%	38.33%	38.32%
HE	63.29%	63.15%	60.43%	60.56%	61.67%	61.68%
By Price						
$399	28.85%	30.25%	26.54%	29.29%	27.54%	29.71%
$649	24.34%	21.80%	22.40%	20.93%	23.24%	21.31%
$899	17.33%	15.22%	16.77%	14.41%	17.01%	14.76%
$1,149	7.43%	10.04%	8.68%	9.65%	8.14%	9.82%
$1,399	5.67%	6.56%	6.41%	6.33%	6.09%	6.43%

Notes:
[1] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[2] Actual take rate for any product attribute (e.g., front-loading design) is the number of times an option featuring the attribute is chosen, divided by the total number of choice tasks.
[3] Predicted take rates are calculated using demand estimates presented in Exhibit 1. Predicted take rate for any product attribute (e..g, front-loading design) is calculated as the sum of predicted probabilities across all choice options featuring the product attribute, divided by the total number of choice tasks.

Exhibit 3
Lifetime Total Discounted and Undiscounted Cost of Tub Cleaner



Sources:

[1] "Affresh Washer Cleaner, HE - 3 tablets, 4.2 oz," available at http://www.google.com/shopping, accessed on January 18, 2015.

[2] "Prime rate, federal funds rate, COFI," *Bankrate*, available at http://www.bankrate.com/rates/interest-rates/prime-rate.aspx, accessed on April 21, 2015.

APPENDIX A

CHRISTOPHER ROLAND KNITTEL
Sloan School of Management
Massachusetts Institute of Technology
100 Main Street
Cambridge, MA 02142
Office: 617-324-0015
Fax: 617-258-6786
knittel@mit.edu
http://web.mit.edu/knittel/www

CURRENT APPOINTMENTS:

2011-present, William Barton Rogers Professor of Energy Economics, Sloan School of Management, Massachusetts Institute of Technology
- 2012-present, Director, Center for Energy and Environmental Policy Research
- 2013-present, Faculty Co-Director, The E2e Project
- 2013-present, Associate Scholar, Harvard Environmental Economics Program
- 2007-present, Research Associate, National Bureau of Economic Research
- Groups: Environmental Economics and Energy, Industrial Organization, and Productivity
- 2014-present, Co-Editor, *Journal of Public Economics*
- 2007-present, Associate Editor, *The Journal of Energy Markets*
- 2013-present, Associate Editor, *The Journal of Transportation Economics and Policy*

PREVIOUS APPOINTMENTS:

2007-2013, Associate Editor, *American Economic Journal – Economic Policy*
2006-2012, Associate Editor, *The Journal of Industrial Economics*
2006-2011, Associate Professor of Economics, University of California, Davis
- 2003-2011, Visiting Research Fellow, University of California Energy Institute
- 2005-2011, Faculty Affiliate, Institute of Transportation Studies, UC Davis
- 2006-2011, Strategy and Policy Thread Leader for STEPS
- 2008-2010, Member, Economic and Allocation Advisory Committee for AB32's cap-and-trade program, State of California

2008-2011, Chancellor's Fellow, University of California, Davis
2002-2006, Assistant Professor of Economics, University of California, Davis
- 2004-2007, Faculty Research Fellow, National Bureau of Economic Research.
- Groups: Environmental Economics and Energy, Industrial Organization, and Productivity

1999-2002, Assistant Professor of Finance and Economics, School of Management, Boston University
1996-1999, Research Assistant, University of California Energy Institute
1994-1996, Teaching Assistant, University of California, Davis

EDUCATION:

Ph.D., University of California, Berkeley, 1999 (Economics)

APPENDIX A

M.A., University of California, Davis, 1996 (Economics)

B.A., California State University, Stanislaus, *summa cum laude*, 1994 (Economics and Political Science)

PUBLICATIONS:

- Christopher R. Knittel, Douglas L. Miller and Nicholas J. Sanders. "Caution Drivers! Children Present: Traffic, pollution and infant health." Forthcoming ***The Review of Economics and Statistics***.
- Holland, Stephen P., Jonathan E. Hughes, Christopher R. Knittel, and Nathan C. Parker. "Some Inconvenient Truths About Climate Change Policy: The Distributional Impacts of Transportation Policies." Forthcoming, ***Review of Economics and Statistics***.
- Holland, Stephen P., Jonathan E. Hughes, Christopher R. Knittel, and Nathan C. Parker. "Unintended Consequences of Transportation Carbon Policies: Land-Use, Emission, and Innovation," joint with Stephen P. Holland (UNC), Jonathan E. Hughes (Colorado), and Nathan Parker (UC Davis--ITS). ***The Energy Journal,*** 36(3).
- Knittel, Christopher R. and Aaron Smith. "Ethanol Production and Gasoline Prices: A Spurious Correlation" ***The Energy Journal***, 36(1).
- Fowlie, Meredith, et. al. "An economic perspective on the EPA's Clean Power Plan." ***Science***, 2014; 346 (6211): 815 DOI: 10.1126/science.1261349.
- Knittel, Christopher R. "The Origins of US Transportation Policy: Was There Ever Support for Gasoline Taxes?" ***Tax Policy and the Economy***, 2014, pp 97-131.
- Knittel, Christopher R. and Konstantinos Metaxoglou. "Estimation of Random Coefficient Demand Models: Challenges, Difficulties and Warnings." ***The Review of Economics and Statistics***, 96(1), March 2014, pp. 34.59.
- Knittel, Christopher R. "Transportation Fuels Policy Since the OPEC Embargo: Paved with Good Intentions." ***The American Economic Review, Papers & Proceedings***, 103(3), May 2013.
- Knittel, Christopher R. and Victor Stango. "Celebrity Endorsements, Firm Value and Reputation Risk: Evidence from the Tiger Woods Scandal." ***Management Science,*** 60(1), January 2014, pp. 21-37.
- Busse, Meghan, Christopher R. Knittel and Florian Zettelmeyer. "Are Consumers Myopic? Evidence from New and Used Car Purchases." ***The American Economic Review***, 103(1), February 2013, pp. 220-256.
- Knittel, Christopher R. "Reducing Petroleum Use from Transportation." ***The Journal of Economic Perspectives***, 26(1), Winter 2012, 93-118.
- Fowlie, Meredith, Christopher R. Knittel and Catherine Wolfram. "Sacred Cars: Optimal Regulation of Stationary and Non-stationary Pollution Sources." ***The American Economic Journal: Economic Policy***, 4(1), February 2012, 98-126.
- Knittel, Christopher R. "Automobiles on Steroids: Product Attribute Trade-offs and Technological Progress in the Automobile Sector." ***The American Economic Review***, 101(7), 2011, pp. 3368-3399.

APPENDIX A

- Knittel, Christopher R. and Konstantinos Metaxoglou. "Challenges in Merger Simulation Analysis," ***The American Economic Review, Papers & Proceedings***, 101(3), May 2011, pp. 56-59.
- Knittel, Christopher R. and Victor Stango. "Strategic Incompatibility in ATMs." ***The Journal of Banking and Finance***, 35(10), October 2011, pp. 2627-2636.
- Knittel, Christopher R. and Jason J. Lepore. "Tacit Collusion in the Presence of Cyclical Demand and Endogenous Capacity Levels." ***The International Journal of Industrial Organization***, 28(2), March 2010, pp. 131-144.
- Stewart, Scott, John J. Neumann, Christopher R. Knittel, and Jeffrey Heisler. "Absence of Value: An Analysis of Investment Allocation Decisions by Institutional Plan Sponsors," ***Financial Analyst Journal***, 65(6), November/December 2009. *Winner of the Graham and Dodd Award of Excellence.*
- Knittel, Christopher R. and Victor Stango. "How Does Incompatibility Affect Prices?: Evidence from ATMs," ***The Journal of Industrial Economics***, LVII(3), September 2009, pp. 557-582.
- Holland, Stephen P., Jonathan E. Hughes and Christopher R. Knittel. "Greenhouse Gas Reductions under Low Carbon Fuel Standards?," ***The American Economic Journal: Economic Policy,*** 1(1), February 2009, pp. 106-146.
- Borenstein, Severin, James Bushnell, Christopher R. Knittel and Catherine Wolfram. "Trading Inefficiencies in California's Electricity Markets," ***The Journal of Industrial Economics***, LVI(2), June 2008, pp. 347-378.
- Feenstra, Robert and Christopher R. Knittel. "Re-Assessing the Quality Adjustment to Computer Prices: Do U.S. Procedures Overstate the Gains?," ***Price Index Concepts and Measurement***, NBER and the Chicago Press.
- Knittel, Christopher R. and Konstantinos Metaxoglou. "Diagnosing Unilateral Market Power in Electricity Reserves Market," ***The Journal of Energy Markets***, 1(1), Spring 2008.
- Knittel, Christopher R. and Victor Stango. "Incompatibility, Product Attributes and Consumer Welfare: Evidence from ATMs," ***The BE Journal of Economic Analysis & Policy, Advances***, 8(1), January 2008. Available at: http://www.bepress.com/bejeap/vol8/iss1/art1.
- Hughes, Jonathan E., Christopher R. Knittel and Daniel Sperling. "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline." ***The Energy Journal***, 29(1), January 2008.
- Heisler, Jeffrey, Christopher R. Knittel, John J. Neumann and Scott Stewart. "Why Do Institutional Plan Sponsors Hire and Fire their Investment Managers?" *Best Paper Award for the 31st NBEA Conference*. ***The Journal of Business and Economics Studies***, 13(1), Spring 2007, pp. 88-116.
- Kim, Dae-Wook and Christopher R. Knittel "Biases in Static Oligopoly Models? Evidence from the California Electricity Market," ***The Journal of Industrial Economics***, LIV(4), December 2006, pp. 451-470.
- Knittel, Christopher R. "The Adoption of State Electricity Regulation: The Role of Interest Groups," ***The Journal of Industrial Economics***, LIV(2), June 2006.
- Knittel, Christopher R. and Michael R. Roberts. "Financial Models of Deregulated Electricity Prices: An Application to the California Market," ***Energy Economics***, 27(5), September 2005, pp. 791-817.

APPENDIX A

- Knittel, Christopher R. "Regulatory Restructuring and Incumbent Price Dynamics: The Case of Local Telephone Markets," ***Review of Economics and Statistics,*** 86(2), May 2004, pp. 614-625.
- Knittel, Christopher R. and Victor Stango. "Price Ceilings as Focal Points for Tacit Collusion: Evidence from the Credit Card Market," ***The American Economic Review***, 93(5), December 2003, pp. 1703-1729.
- Knittel, Christopher R. "Market Structure and the Pricing of Electricity and Natural Gas," ***The Journal of Industrial Economics***, LI(2), June 2003, pp. 167-191.
- Knittel, Christopher R. "Alternative Regulatory Methods and Firm Efficiency: Stochastic Frontier Evidence the US Electricity Industry," ***Review of Economics and Statistics***, 84(3), August 2002, pp. 530-540.
- Borenstein, Severin, James Bushnell, and Christopher R. Knittel. "Market Power in Electricity Markets: Beyond Concentration Measures," ***The Energy Journal***, 20(4), October 1999, pp. 65-88.
- Knittel, Christopher R. "Long Distance Rates: Search Costs, Switching Costs, and Market Power," ***Review of Industrial Organization***, 12(4), August 1997, pp. 519-536.

WORKING PAPERS:

- Blonigen, Bruce A., Knittel, Christopher R., and Anson Soderbery. "Keeping it Fresh: Strategic Product Redesigns and Welfare." In submission.
- Knittel, Christopher R., Konstantinos Metaxoglou, and Andre Trindade. "Dash for Gas: Firm and Market Response to Lower Natural Gas Prices."
- Knittel, Christopher R. and Robert S. Pindyck. "The Simple Economics of Commodity Price Speculation." Revisions requested from ***The American Economic Journal: Macroeconomics***.
- Busse, Meghan, Christopher R. Knittel and Florian Zettelmeyer. "Stranded Vehicles: The Incidence of Gasoline Taxes Through the Lens of Vehicle Values,"
- Busse, Meghan, Christopher R. Knittel and Florian Zettelmeyer. "Did `Cash for Clunkers' Deliver? The Consumer Effects of the Car Allowance Rebate System."
- Busse, Meghan, Christopher R. Knittel and Florian Zettelmeyer. "Who is Exposed to Gas Prices? How Gasoline Prices Affect Automobile Manufacturers and Dealerships." Revisions requested from ***The Journal of Industrial Economics***.
- Knittel, Christopher R. and Robert S. Pindyck. "The Simple Economics of Commodity Price Speculation." Revisions requested from ***American Economics Journal: Macroeconomics***.
- Knittel, Christopher R. and Ryan Sandler. "The Welfare Impact of Indirect Pigouvian Taxation: Evidence from Transportation."
- Huckfeldt, Peter, and Christopher R. Knittel. "Pharmaceutical Use Following Generic Entry: Paying Less and Buying Less."
- Knittel, Christopher R. and Victor Stango. "The Productivity Benefits of IT Outsourcing."

AWARDS, HONORS, AND GRANTS:

- Graham and Dodd Award of Excellence, from ***Financial Analyst Journal***, 2010.
- Tom Mayer Distinguished Teaching Award, 2010
- Chancellor's Fellowship, UC Davis (one of five faculty members), 2008
- Barry D. McNutt Award for Excellence in Automotive Policy Analysis (with Jonathan Hughes and Dan Sperling), 2008

APPENDIX A

- National Science Foundation Grant (with Victor Stango), 2008-2010, $240,000
- Chevron Bio-Fuel Research Grant, 2007-2008, $127,000
- Chevron Bio-Fuel Research Grant, 2007-2008, $77,000
- Chevron Bio-Fuel Research Grant (Co-PI), 2007-2009, $370,000
- Woods Institute for the Environment Leadership Scholar Training, 2007
- Distinguished Paper, 2006 Academy of Finance
- University of California Energy Institute Research Grant, 2005-2006, $50,000
- Best Paper Award for the 31st NBEA Conference
- ASUCD Excellence in Teaching Award, 2004
- University of California Energy Institute Research Grant, 2003
- Faculty Research Grant, UC Davis, 2002, 2003, 20004, 2005, 2006
- Institute of Governmental Affairs Junior Faculty Grant, 2002, 2003, 2004, 2005
- Junior Faculty Research Grant, Boston University, 2001
- Graduate Fellowship, University of California, Berkeley, 1997–1999
- Graduate Fellowship, University of California, Davis, 1994–1996
- Institute of Transportation Fellow, University of California, Davis, 1995–1996
- Student Commencement Speaker, California State University, Stanislaus, 1994

REFEREE SERVICES:

Agricultural Economics, American Economic Review, Bulletin of Economic Research, Census Bureau, *Econometrica, Economic Inquiry, The Economic Journal, Economics Letters, Energy Economics, The Energy Journal, Energy Studies Review, European Economic Review, International Journal of Industrial Organization, International Journal of Power and Energy Systems, Journal of Banking and Finance, The Journal of Business, Journal of Business and Economic Statistics, Journal of Economic Behavior and Organization, Journal of Economic Education, Journal of Economics and Management Strategy, Journal of Futures Markets, Journal of Industrial Economics, Journal Institutional and Theoretical Economics, Journal of Law and Economics, Journal of Political Economy, Politics and Economics, Quarterly Journal of Economics, Rand Journal of Economics, Resource and Energy Economics, Review of Economic Studies, Review of Economics and Statistics, Review of Industrial Organization, Review of Network Economics, Southern Economic Journal, Socio-Economic Planning Sciences, Utilities Policy,* University of California Energy Institute Grant Program, NSF Grant Program

REGULATORY FILINGS:

- Arons, S.M., A.R. Brandt, M.A. Delucchi, A. Eggert, A.E. Farrell, B.K. Haya, J. Hughes, B.M. Jenkins, A.D. Jones, D.M. Kammen, S.R. Kaffka, C.R. Knittel, D.M. Lemoine, E.W. Martin, M.W. Melaina, J.M. Ogden, R.J. Plevin, D. Sperling, B.T. Turner, R.B. Williams, C. Yang, 2007. "A Low-Carbon Fuel Standard for California, Part 1: Technical Analysis." Available Online: http://www.lcfs.ucdavis.edu.
- Brandt, A.R., A.E. Farrell, B.K. Haya, J. Hughes, B.M. Jenkins, A.D. Jones, D.M. Kammen, C.R. Knittel, M.W. Melaina, M. O'Hare, R.J. Plevin, D. Sperling, 2007. "A Low-Carbon Fuel Standard for California, Part 2: Policy Analysis." Available Online: http://www.lcfs.ucdavis.edu.
- Peer Review Comments on AB 1493, California Environmental Protection Agency Air Resource Board, September 2004.

APPENDIX A

- "Comments on the Use of Computer Models for Merger Analysis in the Electricity Industry," (Joint with Severin Borenstein and James Bushnell), Federal Energy Regulatory Commission. Docket No. PL98-6-000, June 1998.
- "A Cournot-Nash Equilibrium Analysis of the New Jersey Electricity Market," December 1997. (Joint with Severin Borenstein and James Bushnell). Filed with the New Jersey Public Utility Commission as testimony on the potential for market power in a deregulated Pennsylvania-Jersey-Maryland Power Pool.

CONSULTING:

Texas Instruments, Inc.
Rembrandt Vision Technologies, L.L.P.
St. Clair Intellectual Property Consultants, Inc.
Customers First! Coalition
Energy Information Agency
Korean Electric Power Company
California Air Resource Board
City of West Sacramento

PH.D. COMMITTEES (FIRST JOB):

MIT:
Stephen Zoepf (on-going)
Parisa Bastini (Cambridge University)
Donald MacKenzie (University of Washington)
Jennifer Peck (Swarthmore)
UC Davis:
Anson Soderbery (Purdue University)
Nick Sanders (chair, SIEPR Post Doc, Stanford University)
Chia-Wen Chen (chair, on-going)
Chenguang Li (University of Wisconsin)
Jonathan Hughes (chair, University of Colorado, Boulder)
Adib Bagh (University of Kentucky, Math and Economics)
Seungjoon Lee (Korean Insurance Research Institute)
Jason Lepore (chair, Cal Poly)
Wei-Min Hu (Peking University)
Byeongil Ahn (Gyeongsang University)
Konstantinos Metaxoglou (chair, Bates and White LLC)
Lan Li (University of Melbourne)
Neil Norman (Cornerstone Research)
Dae-Wook Kim (chair, Korean Institute for Industrial Economics and Trade)
Boston University:
Gustavo Genoni (2002, Finance, IAE, School of Business, Universidad Austral)
John Neumann (2003, Finance, St. John's University)

TEACHING:

- MIT
    - Energy Economics and Policy, MBA (3 times)

        - Rating: Mean 6.5/Median 7 (out of 7)
        - Sloan Rating: 4.8 out of 5
    - Energy Economics and Policy, Undergraduate (2 times)
        - Rating: Mean 6.4/Median 7 (out of 7)
- UC Davis
    - Graduate Empirical Industrial Organization (6 times)
        - Ratings: Mean 4.9 (out of 5)
    - Transportation Economics (4 times)
        - Ratings: Mean 4.7
    - Intermediate Microeconomics (1 time),
        - Ratings: Mean 4.8
    - Undergraduate Industrial Organization (9 times)
        - Ratings: Mean 4.8
- Boston University
    - Modeling Business Decision Making,
        - Spring 2000, Spring 2001 and Spring 2002
        - Ratings: 4.53 (out of 5), 4.77, 4.70
    - Modeling Business Decision Making (honors),
        - Spring 2001 and Spring 2002
        - Ratings: 4.88, 4.70

UNIVERSITY SERVICE:

MIT:
Variety of personnel committees
Energy Minor Oversight Committee
Energy Education Task Force
Executive Education Committee

UC Davis:
2007-2008, Co-writer (with Jean Vandergehst) of a proposal for a Graduate Program in "Energy Science and Technology" and "Energy Policy and Management"
2006-Present, Member, Energy Institute Steering Committee
2008, Founding Faculty Member, UC Davis Energy Institute
2005-2006, Hiring Committee and Interviewing Committee
2004-2005, Hiring Committee and Interviewing Committee
2002-2003, Hiring Committee and Interviewing Committee
2002-2007, Graduate Advisor
Oral committees: Dae-Wook Kim, Konstantinos Metaxoglou, Neil Norman (chair), Seungjoon Lee, Wei-Min Hu, Lan Li (ARE), Sunhwa Lee, Byeongil Ahn (ARE), Michele Amaral, David Ong, Adib Bagh, Jason Lepore, Bei Li, Chenguang Li (ARE), Tina Saitone (ARE), Carlo Russo (ARE), Sandhya Patlolla (ARE), Jon Hughes (TTP), Peter Huckfeldt, Kyungwon Rho, Nick Sanders, Chia-Wen Chen, Joeri de Witt (ARE), In-Sung Lee (TTP), Anson Soderbery, Nils Johnson (TTP), David McCollum (TTP)

Boston University:
2000-2001, Finance Hiring Committee and Interviewing Committee
1999-2000, Finance Hiring Committee

APPENDIX B

Testimony and Depositions in the Last Four Years

Rembrandt Vision Technologies, L.L.P. (deposed)
Rembrandt Vision Technologies, LP v. Johnson & Johnson Vision Care, Inc.
US District Court, Middle District of FL, Case No. 3:11-cv-819-J-32JRK

Round Rock Research, LLC (deposed)
Sandisk Corp v. Round Rock Research, LLC
Northern District of California, SF Division, Case No. 3:11-cv-05243-RS

Rembrandt Vision Technologies, L.L.P. (deposed)
Rembrandt Vision Technologies, LP v. Johnson & Johnson Vision Care, Inc.
US District Court, Middle District of FL, Case No. 3:11-cv-819-J-32JRK

St. Clair Intellectual Property Consultants, Inc. (deposed)
St. Clair Intellectual Property Consultants, Inc. v. Acer, Inc., et al.
US District Court, District Delaware, Case No. 09-354-JJF and 09-704-JJF

Texas Instruments, Inc. (deposed and testified at trial)
US Ethernet Innovations, LLC v. TI, Inc.
Eastern District of Texas, Tyler Division, Case No. 6:11-cv-491-LED

APPENDIX C

Materials Considered List

Case Filings - LG

Consolidated Amended Complaint, *In re: LG Front Load Washing Machine Class Action Litigation*, In the United States District Court for the District of New Jersey, Case No. 2:08-cv-00051-FSH-MAS, May 6, 2008.

Plaintiffs' Memorandum of Law in Support of Plaintiffs' Motion for Class Certification, *In re: LG Front Load Washing Machine Class Action Litigation*, In The United States District Court for the District of New Jersey, Civil Action No. 08-51(FSH)(MAS), March 30, 2011.

Reply Brief in Further Support of Plaintiffs' Motion for Class Certification, *In re: LG Front Load Washing Machine Class Action Litigation*, In The United States District Court for the District of New Jersey, Civil Action No. 08-51(FSH), June 24, 2011.

Expert Report of Sarah Butler, *Harper et al v. LG Electronics USA*, In The United States District Court for the District of New Jersey, Civil Case No. 2:08-cv-00051-MCA-JBC, April 23, 2015.[1]

Case Filings - Other Front-Loading Washer Cases

Sears

Rebuttal Expert Report of Christopher Knittel, PhD., *Butler, et al. v. Sears, Roebuck and Co.*, In The United States District Court for the Northern District of Illinois Eastern Division, Civil Action No. 06 C 7023 Consolidated with 07-CV-0412 and Civil Action No. 08 C 1832, February 2, 2015.

Expert Report of Sarah Butler, PhD., *Butler, et al. v. Sears, Roebuck and Co.*, In The United States District Court for the Northern District of Illinois Eastern Division, Civil Action No. 06 C 7023 Consolidated with 07-CV-0412 and Civil Action No. 08 C 1832, February 2, 2015.[2]

Expert Report of Professor Timothy Bresnahan, *Butler, et al. v. Sears, Roebuck and Co.*, In The United States District Court for the Northern District of Illinois Eastern Division, Case No. 1:06-cv-07023, October 24, 2014.

Amended Expert Report of M. Laurentius Marais, *Butler, et al. v. Sears, Roebuck and Co.*, In The United States District Court for the Northern District of Illinois Eastern Division, Civil Action No. 06 C 7023 Consolidated with 07-CV-0412 and Civil Action No. 08 C 1832, October 25, 2014.

---

[1] This includes consideration of the two surveys described therein.

[2] This includes consideration of the two surveys described therein.

APPENDIX C

Bosch

Expert Report of Marc Rysman, PhD., *Cobb et al. v. BSH Home Appliances Corporation*, In The United States District Court Central District of California Southern Division, Case 8:10-cv-711-DOC-AN, February 14, 2014.

Reply Report of Marc Rysman, PhD., *Cobb et al. v. BSH Home Appliances Corporation*, In The United States District Court Central District of California Southern Division, Case 8:10-cv-711-DOC-AN, June 12, 2014.

Deposition of Marc S. Rysman, Ph.D., *In the Matter of Diana Tait v. BSH Home Appliances Corporation*, Case No. 8:10-cv-711-DOC-AN, Vol. 1, July 1, 2014.

Declaration of Marc Rysman, Ph.D in Support of Plaintiffs' Opposition to Defendant BSH's Motion for Sanctions, *Cobb et al. v. BSH Home Appliances Corporation*, In The United States District Court Central District of California Southern Division, Case SACV10-711 DOC (ANx), August 21, 2014.

Expert Report of Professor Kevin M. Murphy, *Cobb et al. v. BSH Home Appliances Corporation*, In The United States District Court Central District of California Southern Division, Case 8:10-cv-711-DOC-AN, May 12, 2014.

Expert Report of William E. Wecker, *Cobb et al. v. BSH Home Appliances Corporation*, In The United States District Court Central District of California Southern Division, Case 8:10-cv-711-DOC-AN, May 12, 2014.

Whirlpool

Expert Report of Dr. Timothy Bresnahan, *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, March 8, 2013.

Expert Reply Report of Dr. Timothy Bresnahan, *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, August 28, 2013.

Expert Report of Marc Van Audenrode, PhD., *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, May 10, 2013.

Expert Report of Marc Van Audenrode, PhD., *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, November 4, 2013.

Deposition of Dr. Marc Van Audenrode, *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, 1:08-wp-65000 MDL No. 2001 Class Action, July 10, 2013.

Deposition of Dr. Marc Van Audenrode, *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, 1:08-wp-65000 MDL No. 2001 Class Action, December 19, 2013.

APPENDIX C

Rebuttal Expert Report of Joshua Gans, PhD., *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, May 10, 2013.

Rebuttal Expert Report of Dr. Itamar Simonson, *In re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In The United States District Court for the Northern District of Ohio Eastern Division, Case 1:08-wp-65000, December 16, 2009.

Transcript of Trial Proceedings, *In Re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In the District Court of the United States for the Northern District of Ohio Eastern Division, Case No. 1:08WP65000 MDL 2001, October 23, 2014.

Bates Stamped Documents

LGUSA_FLW0002893 – LGUSA_FLW0002920

LGUSA_FLW0010137 – LGUSA_FLW0010212

LGUSA_FLW0032031– LGUSA_FLW0032037

LGUSA_FLW0033034 – LGUSA_FLW0033040

LGUSA_FLW0041609 – LGUSA_FLW0041613

LGUSA_FLW0048952 – LGUSA_FLW0048979

LGUSA_FLW0049392 – LGUSA_FLW0049404

LGUSA_FLW0049405 – LGUSA_FLW0049429

LGUSA_FLW0049430 – LGUSA_FLW0049453

LGUSA_FLW0049525 – LGUSA_FLW0049548

LGUSA_FLW0049799 – LGUSA_FLW0049822

LGUSA_FLW0050355 – LGUSA_FLW0050357

LGUSA_FLW0050781 – LGUSA_FLW0050804

LGUSA_FLW0057932 – LGUSA_FLW0057955

LGUSA_FLW0058024 – LGUSA_FLW0058047

LGUSA_FLW0058052 – LGUSA_FLW0058075

LGUSA_FLW0065937 – LGUSA_FLW0065960

LGUSA_FLW0073205 – LGUSA_FLW0073231

LGUSA_FLW0087036 – LGUSA_FLW0087079

LGUSA_FLW0087080 – LGUSA_FLW0087123

APPENDIX C

LGUSA_FLW0088773 – LGUSA_FLW0088775

LGUSA_FLW0089144 – LGUSA_FLW0089184

LGUSA_FLW0103600 – LGUSA_FLW0103605

LGUSA_FLW0123718 – LGUSA_FLW0123720

LGUSA_FLW0129880 – LGUSA_FLW0129895

LGUSA_FLW0131319 – LGUSA_FLW0131321

LGUSA_FLW0142886 – LGUSA_FLW0142933

LGUSA_FLW0143301 – LGUSA_FLW0143348

LGUSA_FLW0143349 – LGUSA_FLW0143395

LGUSA_FLW0143440 – LGUSA_FLW0143486

LGUSA_FLW0143977 – LGUSA_FLW0144056

LGUSA_FLW0147024 – LGUSA_FLW0147028

LGUSA_FLW0152485 – LGUSA_FLW0152532

LGUSA_FLW0160201 – LGUSA_FLW0160237

MANZELLO00000002 – MANZELLO000000048

P & G 0070 – P & G 0082

PGE010448 – PGE010453

W0539589

Publicly Available Sources

"Affresh Washer Cleaner, HE - 3 tablets, 4.2 oz," 2015, available at https://www.google.com/shopping/product/17138942502923477 87?q=affresh%20washer%20cleaner&rlz=1C1CHFX_enUS503US503&espv=2&biw=1280&bih=631&sqi=2&bav=on.2,or.r_cp.r_qf.&bvm=bv.83829542,d.eXY&ion=1&tch=1&ech=1&psi=qR-8VKL4O4S-ggTB14CYCA.1421615019065.3&prds=paur:ClkAsKraXx8nlQDBtsdh0AJwgEubh6LRG86vZbVa-klTU449vUJSfPBoCQ0bg4B7TK48l-U70G3WRBHjMb5PG2RXWvaXRsMKkFEeXgJ73eNfgkMTcSaiQIH4DhIZAFPVH73tjSVJ6spJkZunFYKRgeqXuc9kGA,scoring:p&ei=sR-8VN-kFcKlgwSNs4O4Aw&ved=0CGkQpiswAA, accessed on January 18, 2014.

"How we test: Appliances & Home products," *Consumer Reports*, available at http://www.consumerreports.org/cro/about-us/whats-behind-the-ratings/testing/appliances-home/index.htm, accessed on January 28, 2015.

APPENDIX C

"How Whirlpool Puts New Ideas through the Wringer," *Bloomberg BusinessWeek*, August 3, 2009, available at http://www.businessweek.com/innovate/content/aug2009/id2009083_452757.htm, accessed on January 26, 2015.

"Passport: Consumer Appliances 2014," *Euromonitor International*, extracted May 10, 2014.

"Prime rate, federal funds rate, COFI," *Bankrate*, available at http://www.bankrate.com/rates/interest-rates/prime-rate.aspx, accessed on April 21, 2015.

"Tide® Washing Machine Cleaner Helps Eliminate Washing Machine Malodor," *Tide Newsroom*, December 18, 2009, available at http://news.tide.com/press-release/tide-washing-machine-cleaner-helps-eliminate-washing-machine-malodor, accessed on April 8, 2015.

"Whirlpool to Sell Cleaner for High-Efficiency Washers," *Reuters*, September 26, 2007, available at http://www.reuters.com/article/2007/09/26/whirlpool-cleaner-idUSN2618448820070926, accessed on January 28, 2015.

AJ Madison webpages, available at http://www.ajmadison.com/cgi-bin/ajmadison/[model number]html?noredir=1, where [model number] is replaced with a specific model number for GE, Kenmore, LG, Maytag, and Whirlpool models reviewed in this report.

Allenby, Greg M., Neeraj Arora, and James L. Ginter, "Incorporating Prior Knowledge into the Analysis of Conjoint Studies," *Journal of Marketing Research*, Vol. 32, No. 2, 1995, pp. 152-162.

Berry, Steven, James Levinsohn, and Ariel Pakes, "Automobile Prices in Market Equilibrium," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 841-890.

Brehm, Jack W., "Postdecision Changes in the Desirability of Alternatives," *The Journal of Abnormal and Social Psychology*, Vol. 52, No. 3, May 1956, pp. 384-389.

Budzinski, Oliver and Isabel Ruhmer, "Merger Simulation in Competition Policy: A Survey," *Journal of Competition Law & Economics*, Vol. 6, No. 2, September 11, 2009, pp. 277-319.

Consumer Reports Buying Guides, 2006-2014.

Davis, Peter and Eliana Garces, "The Determinants of Market Outcomes," In *Quantitative Techniques for Competition and Antitrust Analysis*, Princeton University Press, 2009.

Epstein, Roy J. and Daniel L. Rubinfeld, "Merger Simulation: A Simplified Approach with New Applications," *Antitrust Law Journal*, Vol. 69, 2001, pp. 883-919.

GE, GTWN7450DWW, available at http://products.geappliances.com/ApplProducts/Dispatcher?REQUEST=SpecPage&Sku=GTWN7450DWW.

APPENDIX C

Goldberg, Pinelopi Koujianou, "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 891-951.

Green, Paul E., Abba M. Krieger, and Yoram (Jerry) Wind, "Thirty Years of Conjoint Analysis: Reflections and Prospects," *Interfaces*, Vol. 31, No. 3, 2001, pp. S56-S73.

Hughes, Jonathan E., Chrisopher R. Knittel, and Daniel Sperling, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," *The Energy Journal*, Vol. 29, No. 1, 2008, pp. 113-134.

Ivaldi, Marc and Frank Verboven, "Quantifying the effects from horizontal mergers in European competition policy," *International Journal of Industrial Organization*, Vol. 23, No. 9-10, December 2005, pp. 669-691.

Jacobsen, Mark R., "Evaluating U.S. Fuel Economy Standards in a Model with Producer and Household Heterogeneity," *American Economic Journal: Economic Policy*, Vol. 5, No. 2, May 2013, pp. 148-187.

Jedidi, Kamel and Z. John Zhang, "Augmenting Conjoint Analysis to Estimate Consumer Reservation Price," *Management Science*, Vol. 48, No. 10, 2002, pp. 1350-1368.

Kenmore, 41073, available at http://www.sears.com/kenmore-elite-5.2-cu-ft-front-load-washer/p-02641073000P.

Kim, Dae-Wook and Christopher R. Knittel, "Biases in Static Oligopoly Models?: Evidence from the California Electricity Market," *The Journal of Industrial Economics*, Vol. 54, No. 4, December 2006, pp.451-470.

Knittel, Christopher R. and Konstantinos Metaxoglou, "Challenges in Merger Simulation Analysis," *American Economic Review: Papers and Proceedings*, Vol. 101, No. 3, 2011, pp. 56-59.

Knittel, Christopher R. and Konstantinos Metaxoglou, "Diagnosing Unilateral Market Power in Electricity Reserves Market," *Journal of Energy Markets*, Vol. 1, No. 1, March 25, 2008, pp. 65-95.

Knittel, Christopher R. and Konstantinos Metaxoglou, "Estimation of Random-Coefficient Demand Models: Two Empiricists' Perspective," *The Review of Economics and Statistics*, Vol. 96, No. 1, March 2014, pp. 34-59.

Knittel, Christopher R. and Ryan Sandler, "Carbon Prices and Automobile Greenhouse Gas Emissions: The Extensive and Intensive Margins," In *The Design and Implementation of U.S. Climate Policy*, University of Chicago Press, September 2012, pp. 287-299.

Knittel, Christopher R. and Ryan Sandler, "The Welfare Impact of Indirect Pigouvian Taxation: Evidence from Transportation," February 20, 2013, available at

APPENDIX C

http://web.mit.edu/knittel/www/papers/cobenefits_latest.pdf, accessed on February 2, 2015.

Knittel, Christopher R. and Victor Stango, "Incompatibility, Product Attributes and Consumer Welfare: Evidence from ATMs," *The B.E. Journal of Economic Analysis & Policy*, Vol. 8, No. 1, January 2008, pp. 1935-1682.

LG, WT4801CW, available at http://www.lg.com/ca_en/washing-machines/lg-WT4801CW-top-load-washer.

Luo, Lan, P. K. Kannan, and Brian T. Ratchford, "New Product Development Under Channel Acceptance," *Marketing Science*, Vol. 26, No. 2, 2007, pp. 149-163.

Maytag, MHW7000AW, available at http://www.maytag.com/-%5BMHW7000AW%5D-1106865/MHW7000AW/.

Maytag, MHW8000AW, available at http://www.maytag.com/-%5BMHW8000AW%5D-1106866/MHW8000AW/.

Miller, Nathan and Matthew Osborne "Competition Among Spatially Differentiated Firms: An Empirical Model with an Application to Cement," Economic Analysis Group Discussion Paper, March 2010, available at http://www.justice.gov/atr/public/eag/257581.pdf, accessed on January 27, 2015 (presentation available at http://www.ftc.gov/sites/default/files/documents/public_events/3rd-annual-microeconomics-conference/miller_slide.pdf, accessed on January 27, 2015).

Orme, Bryan K., *Getting Started with Conjoint Analysis*, Third Edition, Research Publishers, Glendale, CA, 2014.

Petrin, Amil, "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, Vol. 110, No. 4, August 2002, pp. 705-729.

Sammer, Katharina and Rolf Wüstenhagen, "The Influence of Eco-Labelling on Consumer Behaviour–Results of a Discrete Choice Analysis for Washing Machines," *Business Strategy and the Environment*, Vol. 15, No. 3, 2005, pp. 185-199.

Sawtooth Software, Inc., "The CBC System for Choice-Based Conjoint Analysis (Version 8)," *Sawtooth Software Technical Paper Series*, available at https://sawtoothsoftware.com/download/techpap/cbctech.pdf, accessed on January 20, 2015.

Sichtmann, Christina, Robert Wilken, and Adamantios Diamantopoulos, "Estimating Willingness-to-pay with Choice-based Conjoint Analysis – Can Consumer Characteristics Explain Variations in Accuracy?" *British Journal of Management*, Vol. 22, 2011, pp. 628-645.

APPENDIX C

Singh, Jagdip and Robert E. Wilkes, "When Consumers Complain: A Path Analysis of the Key Antecedents of Consumer Complaint Response Estimates," *Journal of the Academy of Marketing Science*, Vol. 24, No. 4, Fall 1996, pp. 350-365.

Standard Clothes Washers, U.S. Department of Energy Regulations & Compliance, 2003-2012, available at https://www.regulations.doe.gov/ccms/FTC_archives/standard_clothes_washers.

Taragin, Charles and Michael Sandfort, "The Antitrust Package," May 29, 2014, available at http://cran.r-project.org/web/packages/antitrust/vignettes/manual.pdf, accessed on January 27, 2015.

Use and Care Guides for GE, Kenmore, LG, Maytag, and Whirlpool.

Vita, Mike, "Merger Simulation at the FTC," presentation available at http://www.ftc.gov/sites/default/files/documents/public_events/first-annual-microeconomics-conference/vita.pdf, accessed on January 27, 2015.

Weinberg, Matthew C. and Daniel Hosken, "Using Mergers to Test a Model of Oligopoly," October 15, 2008, available at http://www.ftc.gov/sites/default/files/documents/public_events/first-annual-microeconomics-conference/mweinberg.pdf, accessed on January 27, 2015.

Werden, Gregory and Luke Froeb, "Calibrated Economic Models Add Focus, Accuracy, and Persuasiveness to Merger Analysis," In *The Pros and Cons of Merger Control*, edited by the Swedish Competition Authority, Swedish Competition Authority, Stockholm, 2002, pp. 63-82.

Werden, Gregory J. and Luke M. Froeb, "The Effects of Mergers in Differentiated Product Industries: Logit Demand and Merger Policy," *Journal of Law, Economics, and Organization*, Vol. 10, No. 2, October 1994, pp. 407-426.

Werden, Gregory J. and Luke M. Froeb, "Unilateral Competitive Effects of Horizontal Mergers," In *Handbook of Antitrust Economics*, MIT Press, September 2006.

Werden, Gregory J., Luke M. Froeb, and Timothy J. Tardiff, "The Use of the Logit Model in Applied Industrial Organization," *International Journal of the Economics of Business*, Vol. 3, No. 1, 1996, pp. 83-105.

Whirlpool, WFL98HEBU, available at http://www.whirlpool.com/-%5BWFL98HEBU%5D-1021442/WFL98HEBU/.

Whirlpool, WFW70HEBW, available at http://www.whirlpool.com/-%5BWFW70HEBW%5D-1021630/WFW70HEBW/.

Whirlpool, WFW86HEBC, available at http://www.whirlpool.com/-%5BWFW86HEBC%5D-1021632/WFW86HEBC/.

APPENDIX D

Technical Appendix: Estimating Demand

1. When modeling consumers in a market, economists often assume that consumers choose the product that brings them the most utility. In a standard "discrete choice demand model," the utility consumer *i* gets from product *j* is modeled as:

$$u_{ij} = \alpha_0 - \alpha_1 p_j + \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \beta_n x_{nj} + \varepsilon_{ij} \equiv v_j + \varepsilon_{ij}$$

2. Here, p_j is the price of the product and the Xs are product characteristics. In this case, Xs include brand, design (front-loading vs. top-loading), energy efficiency and capacity. The fact that price enters into the utility assures that not everyone will buy the best product available, since this will have a higher price. The last term, ε_{ij}, is a "random variable" that the researcher does not observe, capturing idiosyncratic tastes that consumers have for specific products (e.g., a consumer who just really likes the way a particular machine looks).

3. In addition to the products in the market, consumers are also introduced an "outside good," the choice of not buying a product in this market. In this case, this amounts to choosing not to buy a washing machine. The utility of the outside good is often "normalized" to zero. (The choice of setting the utility of the outside good to zero has no influence on the model, since the only purpose of the utility function is to tell the consumer which product yields the highest utility; the numbers mean nothing. For example, if we added 100 to the utility value for all of the products, consumers' choices would not change.)

4. With this utility function, researchers using these models typically assume that the ε_{ij} component is identically and independently distributed with the Extreme Value Distribution. This yields the conditional logit model, where the probability of choosing product *j* is given by:

$$P_j = \frac{\exp(v_j)}{1 + \sum_k \exp(v_k)}$$

5. The distribution of the random variable ε_{ij} is generalized in the nested logit model to allow for correlation of the ε_{ij} term among products within the same "nest" or group. The outside good belongs to a group on its own. Let Ψ_g denote the set of products in group *g*, then the probability of choosing product *j* of group *g* is given by:

$$P_j = \frac{\exp(v_j/\lambda_g)\left(\sum_{k\in\Psi_g} \exp(v_k/\lambda_g)\right)^{\lambda_g - 1}}{\sum_h \left(\sum_{k\in\Psi_h} \exp(v_k/\lambda_h)\right)^{\lambda_h}}$$

APPENDIX D

Where the parameter λ_g captures the degree of correlation within the group. The nested logit model reduces to the conditional logit model when λ_g=1 for all groups.

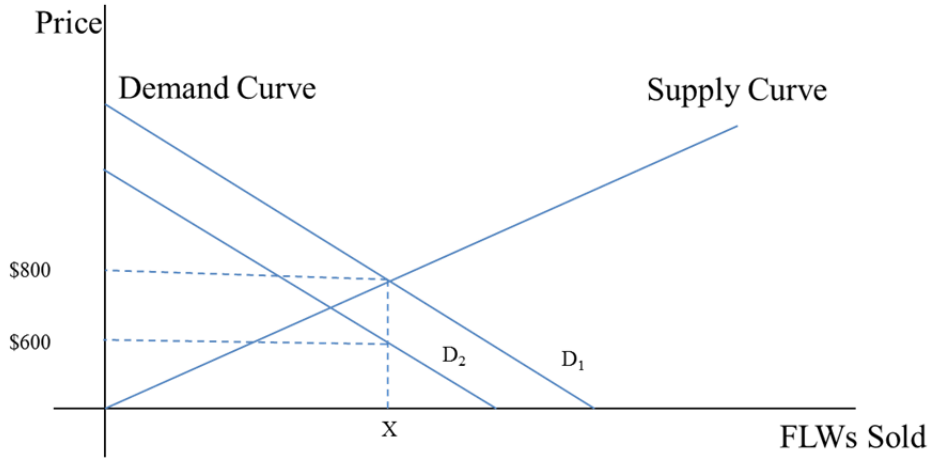
6. One interpretation of the nested logit model is that consumers make a two-stage decision, in which they first choose a group (e.g., front-loading washing machines, top-loading washing machines, or outside good). Given that choice, they make their second stage decision regarding which product within the group to choose. The probability of choosing a product *j*, as specified above, can be re-written as the product of two components—the probability of choosing group *g*; and the probability of choosing product *j* in group *g*, conditional on choosing group *g*.

APPENDIX E

Market Price Overcharge and Price Elevation

1. As I discussed in my report, my approach to estimating market price overcharge damages is conceptually similar to the price elevation methods used by Dr. Van Audenrode in the Whirlpool case and Professor Rysman in the Bosch case. In this Appendix, I describe the two measures and compare them.

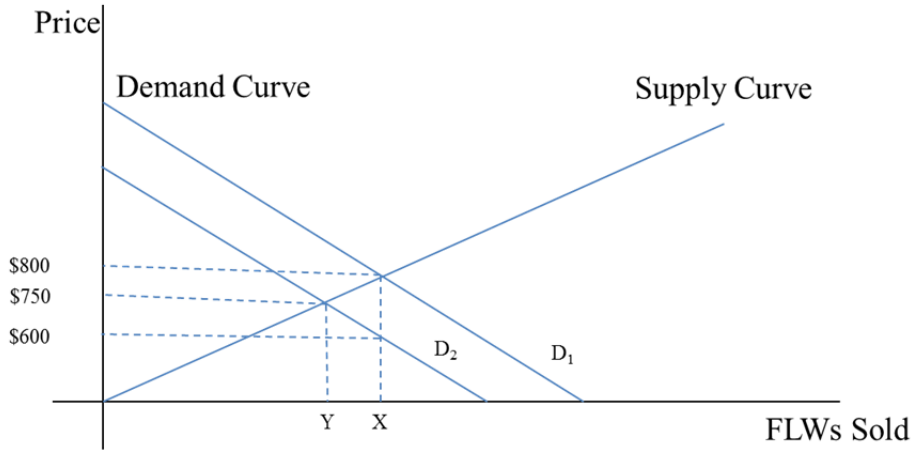
2. To motivate the discussion, let's use an example similar to the car example that I described in my report, but specific to front-loading washers.



3. In the context of this litigation, the two demand curves reflect the actual and but-for world. D_1, in effect, represents consumers' demand for LG front-loading washers that do not have issues with mold, while D_2 represents consumers' demand for LG front-loading washers that do. In the actual world, LG sold X front-loading washers during the class period; my assumption of liability is that these machines did, in fact, have issues with mold, and that consumers were generally not aware of that. Because LG sold X machines at a price of, say $800, a price which it could charge only because consumers believed they were receiving a machine without significant issues relating to mold, the operative question from a damages perspective is what price would LG have needed to charge to sell those same X machines when consumers knew them to have issues relating to mold (i.e., their demand would be reflected by D_2).

4. Dr. Van Audenrode and Professor Rysman, in their respective Price Elevation analyses, also examine the market impact of a shift in demand, but they seek to answer a slightly different question: what would be the *market equilibrium* price of LG front-loading washers in a world where demand were represented by D_2 and not D_1. Graphically, this can be depicted as:

APPENDIX E



5. As the diagram above illustrates, this type of analysis necessarily requires one to make assumptions about the shape and slope of the supply curve, without the benefit of having cost data (as opposed to the demand curve, for which we have data on consumer preferences from the conjoint study).

6. More fundamentally, there exists a significant disconnect between this approach and the nature of the claims in this case. Notice that in the but-for world, as depicted in this diagram, not only does LG sell its front-loading washers for $50 less, but it also sells fewer units. Said differently, Y consumers who bought the LG front-loading washers in the actual world would have done so in the but-for world as well; X-Y consumers who bought the LG front-loading washers in the actual-world would NOT have done so in the but-for world. For that latter group, the price elevation measure of $50 is not relevant. They may have purchased another machine, or may have chosen, in the but-for world, not to purchase any machine. The price elevation approach, therefore, does not capture the economic harm relating to each LG purchased. The market price overcharge approach does; it measures the overcharge on each LG purchased.

7. The downward bias inherent in the price elevation measure of damages, relative to the true damage faced by consumers, will be most severe the flatter are the supply or demand curves. Notice, for example, if the supply curve is horizontal when demand shifts in, there will be no change in price despite the fact that consumer surplus has in fact fallen. In addition, if the market for the product is reasonably competitive, then the demand curve faced by any one individual firm will be nearly horizontal. In this case, if a product has an unknown negative attribute, the firm that produces a product with that negative attribute can sell its product at the market-clearing price. Once the negative attribute is known, however, the sales of the product will go to zero (or close to it) and the market price will remain unchanged. In both of these scenarios,

consumers are harmed by the negative attribute and the price elevation measure would suggest zero harm, underscoring the flaw in the methodology.[1]

8. Two features of the washing machine market would suggest that price elevation will be a poor measure of consumer damages. First, the supply curve is likely to be fairly flat. This is true because there does not appear to be any inputs into the manufacturer of washing machines that are in short supply, thus the input prices are unlikely to increase considerably the more the firm produces. Second, the demand curve is also likely to be fairly flat. This is the case because although the market is not likely to be perfectly competitive, no one firm dominates the market. Thus "residual demand" (i.e., a firm's demand curve, which is the portion of market demand that is not supplied by other firms) is not likely to be steep.[2]

[1] As an example of a case where a product's negative attribute would not lead to a change in market prices consider the following: Suppose a wheat farmer sold wheat that was inferior to other wheat. (Perhaps, the wheat was coated in insecticides.) The wheat industry is a reasonably competitive industry. In a perfectly competitive industry if you take away one firm from the industry, the price is not affected. In this setting, the wheat farmer would be able to sell her wheat if consumers were unaware of the issue. However, once the inferior quality of her wheat became known, consumers would shift to other firms' wheat. Consumers that purchased the inferior wheat would be harmed, but once the quality of the wheat is known the equilibrium price would not change.

[2] Professor Bresnahan's testimony in the Whirlpool Ohio case bears this out. Professor Bresnahan testified that Whirlpool's profit margin was 17 percent, and he described the washing machine industry as a competitive industry (Transcript of Trial Proceedings, *In Re: Whirlpool Corp. Front-Loading Washer Products Liability Litigation*, In the District Court of the United States for the Northern District of Ohio Eastern Division, Case No. 1:08WP65000 MDL 2001, October 23, 2014, at 2833: 7-8 and 2830: 1-4.

APPENDIX F

Illustration of Willingness-to-Pay Calculation

1. In my report, I provided a simple example to motivate the idea of willingness to pay, by showing how to think about the upper and lower bounds in a population of consumers. Here, I extend the discussion to illustrate how the population-wide average willingness to pay can be calculated.

2. As described in my report, in this simplified world, we assume that consumers can choose between only two automobiles in the marketplace. The two models were identical in all respects, except that one featured a 6-cyclinder engine while the other featured an 8-cylinder engine. Suppose we observed that 25 percent of the consumers purchased the car with the 8-cylinder engine when the price of the car with the 8-cylinder engine was $3,000 more than the price of the car with 6-cylinder engine, and the share increased to 75 percent when the price difference was lowered to $1,000; we could then conclude that 25 percent of the consumers placed less than $1,000 of value, 50 percent placed between $1,000 and $3,000 of value, and 25 percent placed at least $3,000 of value on additional horsepower.

3. To estimate consumers' average WTP for the additional horsepower, additional information regarding the distribution of consumers' WTP is required. Assume, for this illustrative example only, that consumers' WTP for the additional horsepower is distributed uniformly across an unknown range from $X to $Y. Because the distribution is uniform, the percentage of consumers choosing to purchase the additional power has a linear relationship with the price for the additional horsepower between $X and $Y, and the mean WTP would be the mid-point between $X and $Y. Thus, if we assume a uniform distribution, we can then infer from the data points above that – namely, that 25 percent of consumers purchased the car with the more powerful engine when the price was $3,000 higher, and, by lowering the price differential even further, to $1,000, the manufacturer was able to induce a further 50 percent to purchase the more powerful car – then mathematically it must be the case that consumers' WTP for the additional horsepower is distributed uniformly between $0 and $4000, with a mean WTP of $2,000.

4. With actual or simulated market data, consumer choices are observed at more price points, but each point also has idiosyncratic noises. The parameters defining the WTP distribution (e.g., the end points of the uniform distribution) can be estimated by matching predicted choices with observed choices, and the mean WTP can then be calculated accordingly.

APPENDIX G

Sensitivity Analyses

1. In this Appendix, I present results of the sensitivity analyses that I have conducted in estimating consumers' demand for washing machines and assessing damages to consumers who purchased the at-issue LG front-loading washers.

2. The baseline demand and damages estimates, as presented in Exhibit 1, are constructed using the following inputs and methodologies:

   - **Demand model**: As discussed in my report, a nested logit model is employed.
   - **Model specification**: As discussed in my report, price enters linearly into consumers' utility function.
   - **Data**: Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washing machines are also excluded.
   - **Estimation method**: Data from control and treatment groups are pooled to estimate a single demand model, with the coefficient for the front-loading feature allowed to vary between the two groups.
   - **Awareness of mold issues with LG front-loaders**: All consumers in the class are assumed to be unaware of mold issues in LG front-loading washers in the actual world.

3. In the following sensitivity analyses, each of the above dimensions is altered and consumer demand and damages are re-estimated.

i. Demand Model

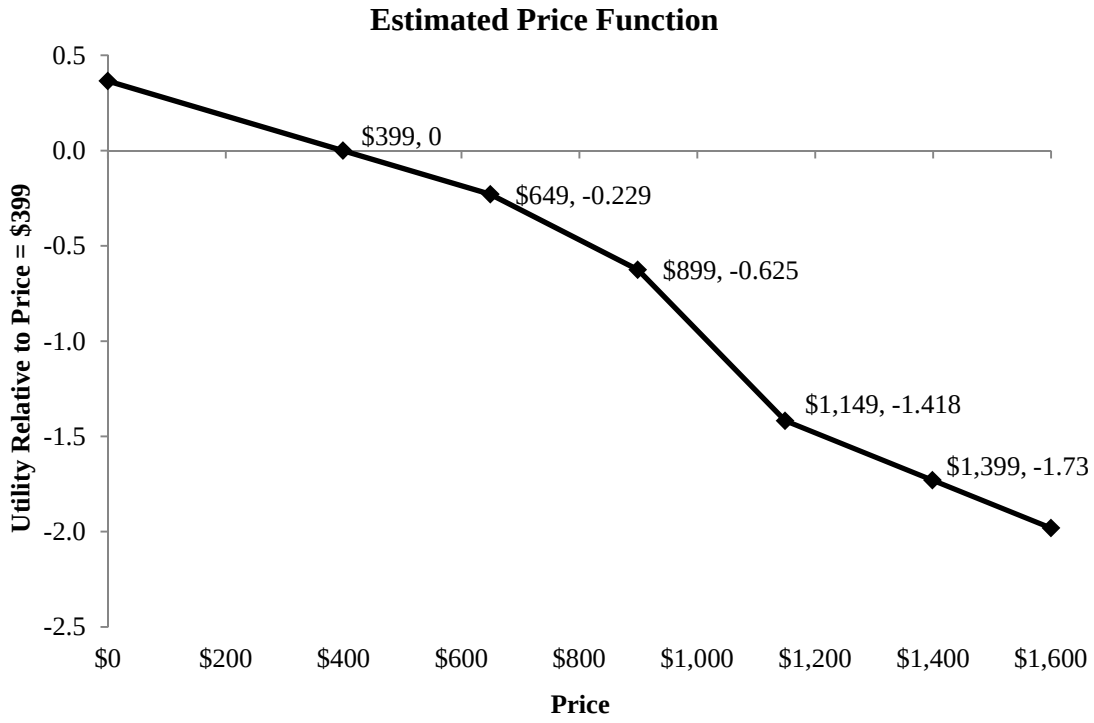
4. Exhibit G1 presents results using a conditional logit, instead of mixed logit specification. Appendix D discusses the differences of the two models. The average value loss and market price overcharge damages amount is $254, very close to the amount estimated using a nested logit model.

ii. Model Specification

5. The baseline model assumes that a consumer's utility from a washer reduces linearly with price. In other words, a price reduction of a dollar increases utility by the same amount, no matter what the price level is. In Exhibit G2, I present results from a demand model specification that allows price to flexibly affect consumer utility.

APPENDIX G

6. The utility level at each of the price points, relative to the lowest price point of $399, is separately estimated through a dummy variable that is set to one for products sold at that price, and zero otherwise. I then interpolate between price points and extrapolate outside the end points to obtain a flexible function of utility on price, as shown in the figure below. Under this flexible functional form, a dollar reduction in price has different effect on utility, depending on the starting price.



Note: Utility relative to price at $399 is extrapolated for prices below $399 based on the slope of the curve between $399 and $649, and extrapolated for prices above $1,399 based on the slope of the curve between $1,149 and $1,399.

7. Given the non-linear relationship between utility and price, consumers' willingness to pay (WTP) to avoid front-loading washing machines with mold issues varies with the price of the washing machine. This WTP is the amount of reduction in price that compensates for the reduction in utility, or loss in value, caused by the mold issue. As shown in Exhibit G2, the average value loss as measured by this WTP varies between $156 and $541 for the price points used in the survey. As the starting price of the washer increases, the average value loss does not move in a single direction – it decreases from $541 to $156, then increases to $308.

iii. Data

8. As explained above, respondents who do not meet Ms. Butler's quality control measures are excluded in the baseline estimation. Respondents in the control group

who indicated that they were aware of mold issues with front-loading washing machines are also excluded.

9. In Exhibit G3-A, all respondents are included in the analysis. In Exhibit G3-B, respondents who do not meet Ms. Butler's quality control measures are included, but control group respondents who were aware of mold issues with front-loaders are excluded.

10. The resulting damages estimates in Exhibit G3-A and Exhibit G3-B are lower than the baseline estimates, which is not unexpected. The inclusion of poor quality survey responses introduces noise to the data that can bias the damages estimates towards zero. Non-attentive respondents are less likely to react to information provided in the Buying Guide, diluting the difference in responses between the control and the treatment groups and leading to an underestimated treatment effect. Similarly, the inclusion of respondents who were previously aware of the mold issue in the control group means that the control group includes respondents who have similar information as that which has been provided to the treatment group, again diluting the difference in responses between the two groups and causing a downward bias in the treatment effect.

iv. Estimation Method

11. Exhibit G4-A and Exhibit G4-B present alternative results when responses from control and treatment groups are analyzed in more or less restrictive fashion than in the baseline specification. In Exhibit G4-A, the demand parameters are first estimated using just the control group. The "front loader" coefficient is then estimated for the treatment group, constraining all other parameters to be equal to those estimated in the control group.

12. A second sensitivity, as presented in Exhibit G4-B, allows all model parameters to vary between the control and treatment groups. Here, because all parameters vary between the test group and the control group, the model measures both a direct effect of information about mold on consumers' preferences for the "front loader" feature, as well as indirect effects on consumers' preferences for other attributes of washing machines, including price and brands. Therefore, to estimate the impact of the mold issue, we cannot look only to the "front-loader" variable; we must examine the spillovers, too. To estimate the difference in consumers' WTP for a LG front-loading washer with and without knowledge of the mold issue, I choose five exemplar LG front-loading washers in the marketplace during the class period. All five models (and only these LG front-loading washers) were reviewed by Consumer Reports in the 2006/2007 timeframe. Using my parameter estimates, for each machine, I calculate consumers' WTP for that machine, with and without knowledge of the mold issue. I

calculate the weighted average of the differences in WTP for each machine, using the predicted take rate of each machine as the weight.[1] The WTP damages in this analysis are $239.

13. Because this model includes direct and indirect effects, care must be taken to apply these effects appropriately in constructing the but-for world for the purpose of estimating market price overcharge damages – an approach that applies both the direct and the indirect effect to not-at-issue front-loading washers would misstate damages. To model the but-for world where liability is found only for LG front-loading washers, in which mold issues were known for LG front-loading washers but not other brands, the direct effect is relevant only with respect to the preferences for LG front-loading washers; for this reason, it would not be appropriate to apply the direct effect to other brands' front-loading washers.[2] However, the indirect effects, which can be thought of as spillovers, may be applied to both LG front-loading washers and all others washers as well. Market price overcharge damages in this analysis are $349.

v. Awareness of Mold Issues with LG Front-Loaders

14. The baseline analysis assumes that no consumers in the class were aware of mold issues. I understand that Ms. Butler found that among respondents in the control group, 25 percent were aware of a mold issue relating to front-loading washers. I consider that a conservative upper bound on the degree of knowledge among class members during the class period, for several reasons. First, I assume that information tends to accumulate in the market over time; therefore, if 25 percent of consumers today are aware of the mold issue, it is likely that significantly fewer had such awareness during the class period, which I understand begins in 2003. Further, even those who reported recently in Ms. Butler's study that they were aware of a mold issue may not be fully aware of its extent and ramifications.

---

1 The "take rate" for a washing machine is the share of consumers (including those who opt not to purchase any machine) choosing to purchase that machine. Predicted take rates are calculated by applying the demand estimates to the set of LG, General Electric, Kenmore, Maytag, and Whirlpool washing machines covered by Consumer Reports in 2006 and 2007.

2 To the extent that one believed that information about LG front-loading washers would directly affect consumers' impressions of, and therefore valuations of other brands' front-loading washers, one would also need to account for the measures that other brands could take to correct consumers' impressions of their brands' front-loading washers (e.g., through comparative marketing). Failure to allow for affected firms to counteract those direct effects as they would in the real world would bias damages estimates downward, because other brands' washers are not allowed to competing as effectively as they would in the real world. In such a modeled "world," LG would not need to lower its price as much as it would if the competing firms were allowed to counteract those spillovers.

APPENDIX G

15. Using the demand estimates presented in Exhibit 1, Exhibit G5-A presents a series of sensitivity analyses on the damages calculations that allow for different levels of awareness among class members, with the share of class members aware of the mold issues ranging from 5 percent to 25 percent. The average value loss damages estimate based on the reduction in WTP ranges from $209 to $265. The market price overcharge damages estimate varies from $220 to $268.

16. Instead of adjusting for consumers' awareness of the mold issues in the damages calculations, as discussed above, an alternative sensitivity analysis can be conducted by making the awareness adjustment at the estimation stage. Exhibit G5-B presents demand estimation results when the analysis includes respondents in the control group who were previously aware of the mold issues associated with front-loaders. The demand parameters for the control group then reflect the average preference across consumers aware of the mold issues and consumers unaware of the mold issues in the control group, which are then compared to the average preference among consumers in the treatment group in the damages calculations. The resulting damages estimates are close to the results in Exhibit G5-A under the assumption that 25 percent of the class members are aware of the mold issues.

Exhibit G1
Conditional Logit Demand Parameters and Damages Estimates

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.049		(0.032)
Maytag	-0.009		(0.032)
Whirlpool	0.108	***	(0.032)
LG	0.070	**	(0.032)
Front Load	0.028		(0.028)
Medium	0.501	***	(0.033)
Large	1.075	***	(0.031)
Extra Large	1.220	***	(0.031)
High Efficiency	1.353	***	(0.022)
Price	-2.043	***	(0.032)
Front Load * Treatment	-0.518	***	(0.036)
Constant	0.300	***	(0.045)
N	85,800		

Damages Measures

Average Value Loss (WTP)	$253.69
Market Price Overcharge	$253.69

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Treatment*Front_Load" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit G2
Nested Logit Demand Parameters and Damages Estimates
Non-linear Price Effect on Utility

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.036		(0.028)
Maytag	-0.006		(0.028)
Whirlpool	0.094	***	(0.028)
LG	0.061	**	(0.028)
Front Load	0.035		(0.029)
Medium	0.438	***	(0.029)
Large	0.945	***	(0.030)
Extra Large	1.068	***	(0.030)
High Efficiency	1.180	***	(0.025)
Price = $649	-0.229	***	(0.024)
Price = $899	-0.625	***	(0.026)
Price = $1149	-1.418	***	(0.036)
Price = $1399	-1.730	***	(0.041)
Front Load * Treatment	-0.496	***	(0.035)
Constant	-0.389	***	(0.045)
λ_{Top}	0.780	***	(0.022)
λ_{Front}	0.760	***	(0.022)
N	85,800		

Damages Measures

	Price	Average Value Loss (WTP)
LG Front-Loaders		
WM1814C[W]	$700.00	$504.23
WM1814C[W]	$800.00	$431.30
WM2277H[W]	$1,100.00	$156.28
WM2432H[W]	$1,250.00	$217.57
WM2688H[N]M	$1,600.00	$397.47
Survey Prices	$649.00	$541.43
	$899.00	$359.10
	$1,149.00	$156.28
	$1,399.00	$307.98

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Average Value Loss (WTP) under the non-linear price assumption, defined as the reduction in price necessary to offset the lost utility implied by the coefficient on "Front Load * Treatment," depends on the starting price of each machine. Average Value Loss is first calculated for each LG front-loading machine covered by Consumer Reports in 2006 and 2007. I also calculate Average Value Loss for four price points used in Ms. Butler's survey.

Exhibit G3-A
Nested Logit Demand Parameters and Damages Estimates
All Respondents

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.014		(0.022)
Maytag	0.015		(0.022)
Whirlpool	0.121	***	(0.022)
LG	0.106	***	(0.022)
Front Load	-0.041	*	(0.022)
Medium	0.368	***	(0.022)
Large	0.798	***	(0.023)
Extra Large	0.929	***	(0.024)
High Efficiency	1.039	***	(0.020)
Price	-1.607	***	(0.029)
Front Load * Treatment	-0.269	***	(0.027)
Constant	0.519	***	(0.034)
λ_{Top}	0.805	***	(0.019)
λ_{Front}	0.803	***	(0.019)
N	132,300		

Damages Measures

Average Value Loss (WTP)	$167.36
Market Price Overcharge	$167.36

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] All data from both control and treatment groups are used.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Front Load * Treatment" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit G3-B
Nested Logit Demand Parameters and Damages Estimates
All Respondents Except Mold-Aware (in Control)

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.020		(0.024)
Maytag	0.003		(0.024)
Whirlpool	0.109	***	(0.023)
LG	0.093	***	(0.023)
Front Load	0.031		(0.025)
Medium	0.352	***	(0.024)
Large	0.770	***	(0.025)
Extra Large	0.907	***	(0.025)
High Efficiency	1.050	***	(0.021)
Price	-1.631	***	(0.031)
Front Load * Treatment	-0.352	***	(0.030)
Constant	0.593	***	(0.036)
λ_{Top}	0.806	***	(0.020)
λ_{Front}	0.803	***	(0.021)
N	115,740		

Damages Measures

Average Value Loss (WTP)	$215.65
Market Price Overcharge	$215.65

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Respondents in the control group who were previously aware of mold issues with front-loading washers are excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Front Load * Treatment" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit G4-A
Nested Logit Demand Parameters and Damages Estimates
Two-Step Demand Estimation

Demand Parameters

	Control			Treatment - Constrained		
Variable	**B**		**Standard Error**	**B**		**Standard Error**
Kenmore	0.020		(0.045)	0.020		
Maytag	0.008		(0.045)	0.008		
Whirlpool	0.164	***	(0.044)	0.164		
LG	0.165	***	(0.044)	0.165		
Front Load	0.062	*	(0.034)	-0.448	***	(0.024)
Medium	0.398	***	(0.045)	0.398		
Large	0.938	***	(0.047)	0.938		
Extra Large	1.087	***	(0.048)	1.087		
High Efficiency	1.277	***	(0.039)	1.277		
Price	-2.036	***	(0.059)	-2.036		
Constant	0.445	***	(0.068)	0.445		
λ_{Top}	0.862	***	(0.037)	0.862		
λ_{Front}	0.810	***	(0.034)	0.810		
N	37,140			48,660		

Damages Measures

Average Value Loss (WTP)	$250.59
Market Price Overcharge	$250.59

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Model first estimated on control group data, then on treatment group data (with all coefficients except the one for "Front Load" constrained to be estimates from the control group estimation). Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Treatment*Front_Load" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit G4-B
Nested Logit Demand Parameters and Damages Estimates
Treatment Effect on All Product Attributes

Demand Parameters

Variable	B		Standard Error
Kenmore	0.020		(0.042)
Maytag	0.006		(0.043)
Whirlpool	0.160	***	(0.042)
LG	0.159	***	(0.042)
Front Load	0.046		(0.031)
Medium	0.374	***	(0.042)
Large	0.886	***	(0.042)
Extra Large	1.027	***	(0.043)
High Efficiency	1.209	***	(0.033)
Price	-1.933	***	(0.050)
Constant	0.501	***	(0.063)
Treatment * Kenmore	-0.100	*	(0.056)
Treatment * Maytag	-0.013		(0.056)
Treatment * Whirlpool	-0.099	*	(0.055)
Treatment * LG	-0.159	***	(0.055)
Treatment * Front Load	-0.502	***	(0.038)
Treatment * Medium	0.089		(0.056)
Treatment * Large	0.074		(0.054)
Treatment * Extra Large	0.040		(0.053)
Treatment * High Efficiency	-0.073	*	(0.038)
Treatment * Price	0.276	***	(0.056)
Treatment * Constant	-0.104		(0.081)
λ_{Top}	0.768	***	(0.022)
λ_{Front}	0.751	***	(0.022)
N	85,800		

Damages Measures

Average Value Loss (WTP)	$239.13
Market Price Overcharge	$348.53

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware of mold issues with front-loading washers are also excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is first calculated for each LG front-loader as the difference in WTP between control and treatment groups, then averaged across all LG front-loaders using predicted take rates for the control group as weights.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant. In the but-for world, treatment effect on the front-loading feature is only applied to the LG front-loaders, while treatment effects on all other attributes are applied to all washing machines.

Exhibit G5-A
Damages from Nested Logit Demand Parameters
Alternative Actual-World Mold Awareness Assumptions

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.037		(0.028)
Maytag	-0.002		(0.028)
Whirlpool	0.102	***	(0.027)
LG	0.070	**	(0.027)
Front Load	0.042		(0.029)
Medium	0.424	***	(0.028)
Large	0.926	***	(0.030)
Extra Large	1.048	***	(0.030)
High Efficiency	1.165	***	(0.025)
Price	-1.773	***	(0.037)
Front Load * Treatment	-0.495	***	(0.035)
Constant	0.444	***	(0.042)
λ_{Top}	0.771	***	(0.022)
λ_{Front}	0.748	***	(0.022)
N	85,800		

Damages Measures

	Share of Consumers Aware of Mold		
	5.0%	**10.0%**	**25%**
Average Value Loss (WTP)	$265.05	$251.10	$209.25
Market Price Overcharge	$267.44	$255.70	$219.31

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded. Respondents in the control group who were previously aware o mold issues with front-loading washers are also excluded.
[3] In the actual world, 5, 10, or 25 percent of consumers are assumed to be aware of mold issues with respect to LG front-loading washers; in the but-for world, all consumers are assumed to be aware of mold issues with respect to LG front-loading washers. Consumers are assumed to be unaware of mold issues with repect to other brands of front-loading washers in both actual and but-for worlds.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Change in WTP is calculated as the ratio of the coefficient on "Front Load * Treatment" to the coefficient on "Price," multiplied by -1,000, for consumers who are not aware of the mold issues; and zero for consumers who are aware of the mold issues in the actual world. Average Value Loss (WTP) is the average change in WTP across all consumers, which is equal to the change in WTP for consumers unaware of the mold issues multiplied by the share of consumers unaware of the mold issues.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.

Exhibit G5-B
Nested Logit Demand Parameters and Damages Estimates
Mold-Aware Respondents (in Control) Included

Demand Parameters

Variable	B		Standard Error
Kenmore	-0.035		(0.026)
Maytag	0.006		(0.026)
Whirlpool	0.114	***	(0.026)
LG	0.080	***	(0.026)
Front Load	-0.054	**	(0.026)
Medium	0.448	***	(0.027)
Large	0.966	***	(0.028)
Extra Large	1.082	***	(0.029)
High Efficiency	1.152	***	(0.023)
Price	-1.768	***	(0.034)
Front Load * Treatment	-0.384	***	(0.033)
Constant	0.369	***	(0.039)
λ_{Top}	0.771	***	(0.020)
λ_{Front}	0.750	***	(0.021)
N	98,340		

Damages Measures

Average Value Loss (WTP)	$217.44
Market Price Overcharge	$217.44

Notes:
[1] *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.
[2] Data from both control and treatment groups are used. Per Ms. Butler's instruction, respondents who (i) took more than 30 minutes to complete the survey, (ii) took less than one minute to complete the conjoint exercises, (iii) took less than 30 seconds to read the Buying Guide, or (iv) did not correctly recall the feature that was not described in the Buying Guide are all excluded.
[3] In the actual world, consumers are assumed to be unaware of mold issues with respect to any brand of front-loading washer; in the but-for world, consumers are assumed to be aware of mold issues with respect to LG front-loading washers.
[4] Price and other product attributes of washing machines available in the marketplace are based on LG, General Electric, Kenmore, Maytag, and Whirlpool models covered by Consumer Reports in 2006 and 2007.
[5] Average Value Loss (WTP) is calculated as the ratio of the coefficient on "Treatment*Front_Load" to the coefficient on "Price," multiplied by -1,000.
[6] Market Price Overcharge is the weighted average price reduction of LG machines in the but-for world that would allow each LG front-loading washer to maintain the same estimated take rate as that in the actual world, keeping the prices of all other brands constant.